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New Theories in Tempering Steel

By Alfred Heller

IT IS the general impression among toolmakers that tempering is secondary in importance to hardening, and because of this tempering is often carelessly done. Toolmakers are usually more interested in whether the steel is in one piece after leaving the quenching bath, or whether it will resist the file test, than they are in the subsequent tempering operation. Tempering, when properly done, becomes an exact science, and any desired hardness within the limits of the steel can be reproduced with a remarkable degree of accuracy. When steel is properly hardened and tempered it is possible to reproduce at will a given hardness to within plus or minus one-half point on the Rockwell scale, and methods will be described for obtaining such accuracy. Later it will be shown that there are critical ranges in tempering just as in hardening, and that decided changes of structure occur in the steel in passing through these ranges, and also that at these points a variation of only 25 deg. F. can "make or break" a tool. Methods of tempering will be contrasted, and a new method will be described for tempering a tool quickly to replace the inaccurate temper color method which is usually used under these conditions. All conditions affecting the appearance of the temper colors will be carefully investigated, and a temper color scale will be developed in which time as well as temperature is considered. The time element in tempering will be carefully considered, and a minimum length of time for tempering determined to give consistent and accurate results. In order to get a clear conception of tempering it is necessary to know what happens in hardening a piece of steel. Steel from a chemical standpoint is a mixture of iron with carbon, silicon, and manganese, together with such elements as sulphur, phosphorus, oxygen, and nitrogen held as impurities. In the case of the alloy steels, metals such as chromium, tungsten, vanadium, nickel, cobalt, molybdenum, or uranium are added, either singly or in combination, to impart certain physical or chemical properties to the steel. Iron in steel exists in two forms, called alpha and gamma. These forms of iron have different physical properties and in general exist at entirely different temperatures. Gamma iron normally exists, for example, at

Physical properties in the steels used in parts are of great importance to the machine builder. The author explains how some of these properties are developed. Some of the theories are new, are not entirely accepted by metallurgists, and may be considered radical. They are given here in the hope of bringing out discussion that will serve to advance general knowledge of the subject of hardening and tempering of steels

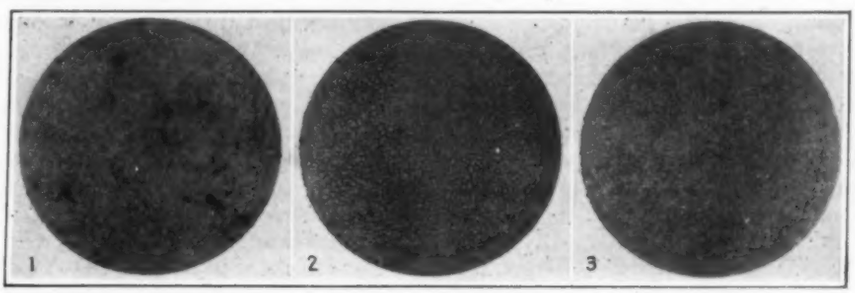


Fig. 1—Poorly annealed tool steel, showing laminated structure. Fig. 2—Tool steel rolled at too high a temperature. The carbide has segregated in the furnace. Fig. 3—Properly rolled and annealed tool steel.

The first of three articles. The second will appear in an early issue.

a comparatively high temperature (1,350 deg. F., or above, depending on the type of steel). It is non-magnetic, of greater density than alpha iron, and absorbs carbon quite readily. Alpha iron on the other hand exists ordinarily at temperatures below 1,350 deg. F., is strongly magnetic, and has very little power to absorb carbon. In the annealed state carbon exists in steel as iron carbide, Fe_3C, or in the case of some alloy steels as double carbides of iron with carbon and another metal, such as tungsten.

Heating Steel for Hardening

We can compare a plain carbon tool steel with a mixture of rock salt frozen in very cold ice. The rock salt would represent iron carbide and the ice alpha iron. As the ice is heated it reaches its melting point and in melting dissolves the rock salt. As alpha iron is heated and passes its critical temperature it changes from alpha to gamma iron and suddenly acquires the power to dissolve carbon. The iron carbide thereupon is forced to break up into its component elements and the free carbon atoms now arrange themselves systematically and uniformly between the gamma iron atoms, and the carbon is said to have dissolved in the iron. The gamma iron, however, remains solid, and is not like water in this respect. This uniform diffusion of carbon and gamma iron atoms is called a solid solution of carbon in iron, and is known as "austenite." It is hard to see how the atoms of these various elements move and rearrange themselves in solid iron, but they do move, and with remarkable results.

However, the solution of the carbon by the gamma iron is not effected immediately. With rock salt and water the time of solution of the rock salt and the water will depend on the size of the particles of rock salt and on the temperature of the water. Finely powdered salt will dissolve more readily than large particles, and the warmer the water the faster it will dissolve the rock salt. Moreover, for each degree of temperature, the water is capable of dissolving only a certain and definite quantity of salt, and when it has dissolved this maximum amount the water is said to be saturated for this particular temperature the solution being known as a saturated solution of rock salt in water. The warmer the water is the more rock salt it will dissolve. The action of iron carbide and steel is almost identical. Gamma iron at 1,365 deg. F. would compare with water at 32 deg. F., and is only capable of dissolving 0.85 per cent of carbon in 15 minutes of time. In fact it will only dissolve this amount at this temperature if the iron carbide is in the form of very small spheroids, the steel being in the condition known as "spheroidize annealed." If the iron carbide is segregated in larger particles or in the laminated condition due to improper forging or annealing, higher temperatures will be necessary to effect solution. In the micro-photographs, Figs. 1, 2, and 3, the structure under different conditions is shown.

With alloy steels containing tungsten the arrangement is further complicated by the double carbide of tungsten and iron, Fe_4W_2C, dissolving in gamma iron, and because of the fact that iron alloys with metals such as chromium and cobalt to form solid solutions of these metals with both alpha and gamma iron. Take the case of a certain brand of high-speed steel which contains 0.70 per cent carbon, 0.32 silicon, 0.20 manganese, 17.25 tungsten, 4.00 chromium, 4.50 cobalt, 1.00 vanadium and 0.50 per cent molybdenum. With such a steel complete solution of the carbides is never effected, even if a hardening heat of 2,400 deg. F. be used. However, the percentages of the carbides that do dissolve form a uniform solid solution so that we have gamma iron atoms with a uniform dispersion of chromium, carbon, tungsten, vanadium, cobalt and molybdenum atoms.

Movement of Atoms in Quenching

When carbon tool steel is properly and uniformly heated for hardening we have a uniform arrangement of carbon atoms between gamma iron atoms, this solution being known as austenite. In quenching in either brine or water the surface temperature is lowered several hundred degrees in a few seconds of time. It is a well-known fact that rapidly cooling a piece of carbon tool steel lowers its critical temperature, that is, it lowers the temperature at which gamma iron changes to alpha iron, and that the faster the rate of cooling the more this critical temperature will be depressed. At first this depression is gradual, and continues so until about 1,200 deg. F. has been reached, then as the rate of cooling is increased there is a sudden acceleration in the rate of depression, the critical temperature suddenly dropping from 1,100 or 1,200 deg. F. to about 550 deg. F. When this rate of cooling is reached it is known as the critical rate of cooling, and in all cases results in the formation of hard steel known as martensite.

As the temperature of the gamma iron is lowered rapidly during a quench the gamma iron becomes harder and harder, and consequently both carbon and iron atoms find their motion more difficult. When 550 deg. F. is reached the change from gamma to alpha iron takes place over a very short period of time. The iron is quite hard at this temperature, and carbon atoms and gamma iron atoms interfere with each other's free movement. Much of the gamma iron, however, does change to alpha iron, and the alpha iron immediately forms exceedingly small and exceedingly hard alpha iron crystals.

A large percentage of the carbon atoms do not find time or enough freedom of movement to unite with three iron atoms to form iron carbide, and hence a great many are held, against their natural inclination, as carbon atoms held in uniform solution by alpha iron. Similarly it is not surprising to find some gamma iron trapped and held as such, retained austenite, and we will see later that even with low hardening heats a plain water-hardening carbon tool steel always retains some gamma iron.

Cause of Brittleness

It is not hard to see that any considerable amount of carbon held in solution against its natural inclination in alpha iron would be a source of brittleness, and freshly hardened carbon tool steel with this excess carbon held in solution is extremely brittle, the brittleness increasing with the amount of carbon retained in solution, which amount will in turn increase in direct proportion to the hardening temperature.

Likewise, retained gamma iron is a source of brittleness that will increase with the amount retained, and this amount in turn will increase with the hardening temperature. As soon as this retained gamma iron, austenite, is converted to alpha iron in tempering a marked increase in toughness is experienced with very little decrease in hardness.

Similar changes take place with alloy steels in quenching, but the interference of the various atoms with each other is so effective that much slower cooling is possible to obtain hard steel. Thus, many of these steels are oil hardening, and in the case of alloy steels containing 1.50

to 2.00 per cent of carbon, together with high percentages of chromium and cobalt, or chromium and tungsten, cooling in still air is possible for maximum hardness.

At this point it may be well to consider what causes hardness after quenching. Steel has a crystalline structure. When a force of sufficient magnitude to cause a permanent deformation in steel is applied the crystals do not slip at their grain boundaries, but slipping usually takes place along slip planes through a crystal. Therefore slipping forms new and smaller grains, and as the grains become smaller the resistance to slipping becomes greater and the steel becomes harder. If extremely hard iron carbide is present along a slip plane in the form of a great many small particles, then this carbide acts as a key across the slip plane, and tends to prevent slipping. Therefore, if the alpha grains are small with extremely small particles of iron carbide contained within them the steel would offer a maximum resistance to slipping, and therefore would be very hard. This theory to explain the hardening of steel is known as the "slip interference theory," and was first proposed by Zay Jeffries.

When water-hardening steel is quenched alpha crystals only begin to form at 550 deg. F. This temperature is too low for the alpha crystals to grow to any size even if they had time to do this. Therefore, the material resulting from the fast cooling, and the low temperature at which these alpha crystals form, has a crystalline structure so minute that its crystals cannot be seen under the most powerful microscope, and are therefore much less than a 100,000th part of an inch in diameter. The iron carbide which forms is also submicroscopic, so that the combination of extremely small-grained alpha iron keyed together by innumerable particles of very fine and very hard iron carbide makes a very hard steel.

Effect of Rapid Cooling

If the cooling is extremely rapid, as in the case of small pieces, less than the usual amount of iron carbide is precipitated, and there is not enough present to give the maximum keying effect. We would expect the steel under these conditions to be somewhat softer, and this is found to be the case. If, for example, a piece of carbon tool steel were heated to 1,400 deg. F. and quenched, it will show an average Rockwell hardness of C66.5. If the piece is heated in boiling water for thirty minutes it will increase in hardness to C68.3. The explanation of the increase in hardness is that the cooling of these pieces was too rapid for the normal amount of iron carbide to form. Boiling in water gave enough freedom of motion to allow this normal amount to form, and hence there was an increase in hardness. Ordinarily pieces of steel are of sufficient size that the heat from the center of the piece quenched causes the surface of the steel to remain at 212 deg. F. for a considerable length of time. This can be readily determined by placing the hand on a piece of steel toward the end of a quench, and after apparently all action has ceased. This has the same effect as tempering at 212 deg. F., or slightly above, and therefore causes the amount of iron carbide to form that would be precipitated by drawing very small pieces at 212 deg. F. For this reason water-hardening carbon tool steel has a surface hardness of C68.3 in most cases.

As gamma iron is softer than alpha iron, and high hardening heats cause the retention of considerable quantities of gamma iron, the tendency would be to have slightly softer steel when a high quenching heat is used with a high carbon steel. A 1.15C tool steel quenched at 1,400 deg. F., and drawn to 350 deg. F. will show a Rockwell hardness of C65.0, whereas if quenched at 1,550 deg. F. a Rockwell hardness of only C63.5 will be obtained after drawing to 350 deg. F. But after the gamma iron breaks up between 450 and 475 deg. F. in drawing, conditions will be reversed, and the steel quenched at 1,550 deg. F. will be harder than the steel quenched at 1,400 deg. F.

The slip interference theory makes it easy to understand why steel softens in tempering. As heat is applied to hardened steel, molecules of alpha iron are forced to move, carbon goes out of solution, alpha crystals begin to grow, and the steel softens in direct proportion to the growth of these crystals. Their growth is retarded by retained gamma iron, carbon in solution, and by the presence of various alloying metals such as chromium, vanadium, or tungsten in solid solution with alpha iron. Therefore, alloy steels soften at a slower rate in tempering than does plain carbon tool steel. That gamma iron is retained in hardened steel is proved by the use of the X-ray, electrically, and volumetrically. The volumetric proof will be given under volume changes in hardening and tempering water hardening carbon tool steel.

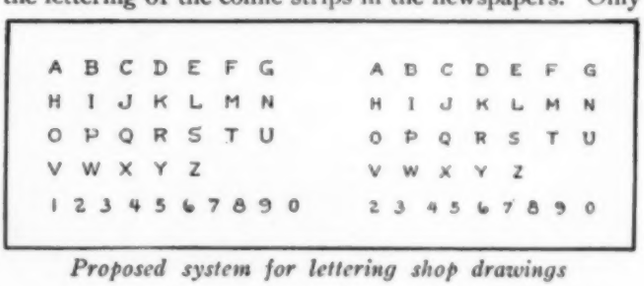
Lettering Shop Drawings

By Charles S. Hazard

MIS-READ drawings are the greatest producers of harsh words, sour dispositions and spoiled work. Hence, the most important parts of any blueprint are the words and figures.

Many sad experiences have convinced me that the Reinhart system of "lower case" (small) letters, though adopted by technical schools and by many large organizations, including the *American Machinist,* is not practical for shop drawings. This style of lettering may look pretty on a printed page, and it may be easy to write; but it is not easy to read on an oil-soaked blueprint. Small *a* and *e* look like *o; v, r* and *i* all look alike. Numeral 4 looks like 9, and 9 looks like 8. "Drill ¾ deep" is sometimes read "Drill 1¾ deep" and sometimes can't be read at all.

To make our drawings foolproof, we ought to copy the lettering of the comic strips in the newspapers. Only



Proposed system for lettering shop drawings

capital letters are used there, and you don't have to be a college graduate to read them. (In fact, there's where a lot of us learned to read.)

As a basis for discussion, the alphabet herewith is suggested. Those tags and trimmings on several of the characters are neither accidents nor ornaments; they are absolutely necessary to prevent reading *B* as 8, *7* as 1, and so on.

Efficiency experts may claim that this alphabet takes too much time; but isn't it worth while to spend a few more seconds of the draftsman's time to give the workman a readable blueprint instead of a Chinese puzzle?

Welding in Airplane Work

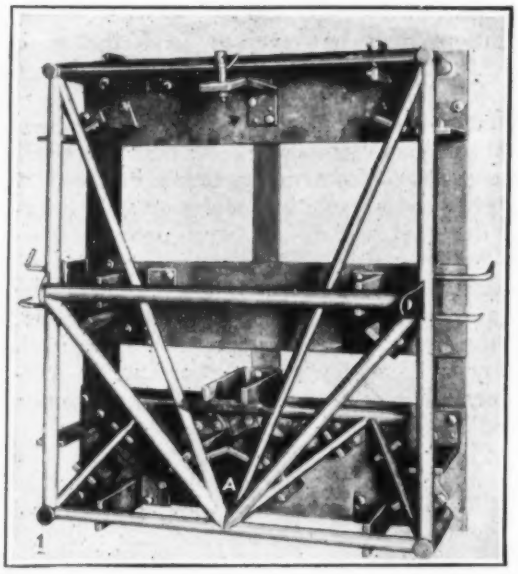
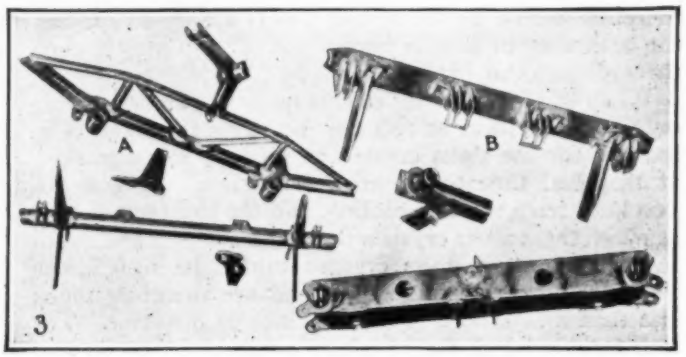


Fig. 1 — Fixture used in assembling parts necessary in building up a cross-member for an airplane fuselage. The various tubes are cut to length and the ends shaped to fit the adjoining members. They are then assembled in this fixture and held firmly in place while being welded. To make the joint at *A* would be almost impossible by any other method than welding. The pins at the four corners represent the tubes that form the longerons

Photograph by courtesy of the
Curtiss Aeroplane and Motor Co., Buffalo, N. Y.

Fig. 3—A few of the minor assemblies before final welding into the complete fuselage. These show interesting examples of the way in which the various members are built up and the large part that welding now plays in the construction of the modern airplane. The pieces at *A* and *B* are particularly good examples of this as it would be almost impossible to produce them by any other method. The ease with which all brackets or arms can be attached to a tube or other portion makes it possible to secure almost any shape desired



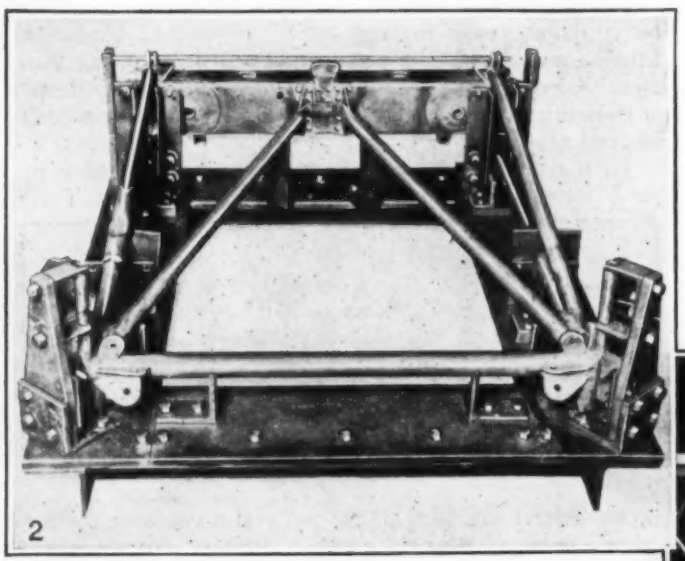
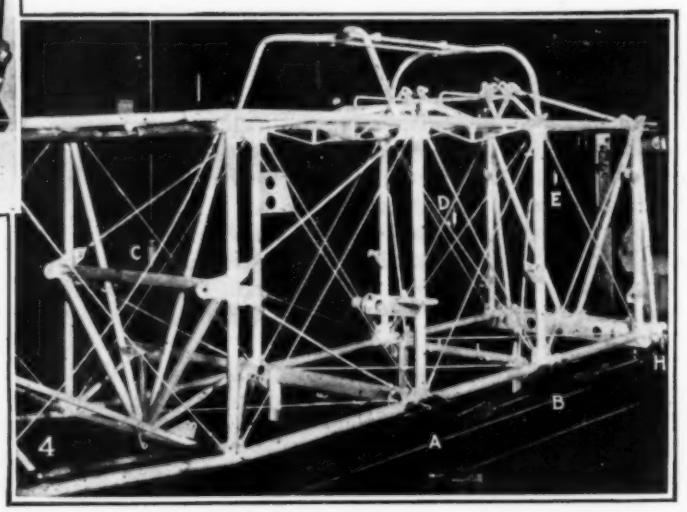


Fig. 2—Another welding fixture. This is for the cross-member shown at the front of the completed fuselage in Fig. 4. It also shows that riveted joints are used in some places, such as the center of the member at the upper side of the illustration. The joints at the corners nearest the reader are shown both before and after welding. The use of substantial fixtures of this kind insure the subassemblies duplicating each other and so make it easy to secure proper alignment in the final assembly

Fig. 4—Section of a steel fuselage showing the many welded joints and the way in which proper alignment is secured. In addition to the use of the welding fixtures and the positive way in which they hold the various members in place. Gages are used such as *A* and *B*, so as to be sure that the various fittings align perfectly. Plumb bobs are also used at various points as *C*, *D*, *E* and *H*. The first three hang from a center line to check the proper balance of the fuselage, while the fourth tests the alignment of the vertical members



Annealing Sheet-Metal Shells in a Semi-Continuous Furnace

By Frank W. Curtis
Western Editor, American Machinist

Constructional features of an annealing furnace that handles the annealing of deep-drawn sheet-metal shells economically and with a minimum amount of hand labor

In order to handle the annealing of deep-drawn sheet-metal shells between draws, the Inland Metal Products Corporation, Chicago, Ill., constructed the furnace illustrated in diagrammatic form in Fig. 1, which is of the half-muffled type, oil fired, and arranged so that the work enters the heating chamber at one end, and passes out at the opposite end. In laying out the unit, special attention was given to the work-handling facilities as it is realized to what extent these affect the ultimate economy to be secured. It frequently happens that this may seriously affect dividends.

Shells to be annealed are placed in a sheet-metal frame, resembling a bottomless box, which rests on a cast-iron baseplate positioned at the loading end of the furnace, an ordinary shovel being used to scoop the shells from the floor into the frame. The number of pieces loaded per frame depends upon the size of the shells, the only precaution necessary being to avoid excessive loading that would cause the work to fall off while passing through the furnace chamber. The baseplate is constructed with ribs so that the continuous heatings will not warp it. To load a baseplate and a frame load of shells into the furnace it is necessary first to open the furnace door and then to operate the air cylinder shown at the right. The plunger of the cylinder, which has a stroke of 42 in., strikes the end of the baseplate and pushes the charge into the heating chamber a small distance beyond the inside wall of the furnace door. Two rails, arranged longitudinally within the furnace, 1½ in. in diameter, form a track on which the baseplate slides. The rails extend beyond the furnace at the loading end, thus providing a resting place for the baseplate and the frame. The furnace chamber, 30 in. in width, 32 in. in height and 12 ft. in length, accommodates five baseplates that measure approximately 25-in. square. When the furnace is completely filled with five trays, the loading of a new charge causes a baseplate with a frame load of annealed shells to be forced out automatically at the opposite end of the furnace. At this end, the furnace has attached to it an extension rack equipped with rollers, to enable the annealed charge to pass out to the unloading position. In this location the shells are emptied into a wheelbarrow, after which the frame is replaced on the baseplate. Then the baseplate is picked up by tongs suspended from an overhead I-beam trolley, and is returned to the loading end of the furnace.

By using the baseplate over again as soon as it has been emptied, it is possible to reload it and get it into the furnace before any appreciable amount of heat has been lost. This feature enables the work to become heated more rapidly than if a cold baseplate were used, thus cutting down the work cycle to an appreciable extent. This practice also saves more fuel than might be imagined and adds to the economy of the operation.

The heat is regulated so that two-thirds of the furnace chamber is used for preheating purposes and the balance for the peak heat. The peak heat for sheet-steel shells is 1,275 to 1,300 deg. F., and for brass shells approximately 900 deg. F. However, the procedure for heating brass work differs, due to the characteristics of brass, which call for a minimum amount of disturbance or agitation while heated at the annealing temperature. The practice is to load the shells in a sheet-metal box and then to remove the box and the shells

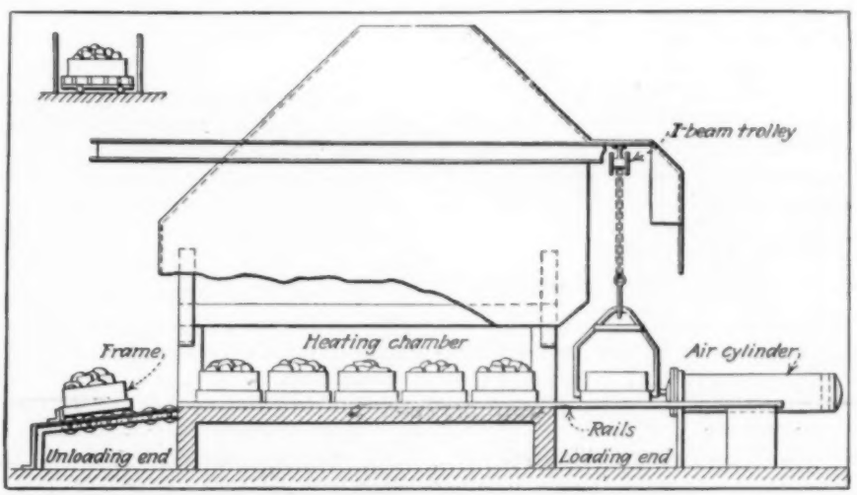


Fig. 1—Diagrammatic layout of the annealing furnace

from the baseplate and allow them to cool together before re-using the box. The baseplate, however, is re-used immediately.

When light-gage material is being annealed, two men operate the furnace, inasmuch as this type of work absorbs the heat more rapidly than work of a heavier nature. A charge of such shells is annealed in about 5 min., the exact time depending, of course, on the characteristics of the work. However, when work of the heavier gage is run through, it is possible for one man to attend to the entire operation of the furnace, in which case the rate of output in number of pieces is somewhat less than that of the lighter work but the labor cost is less.

The I-beam trolley passes around three sides of the furnace, as illustrated in Fig. 2, and is arranged so

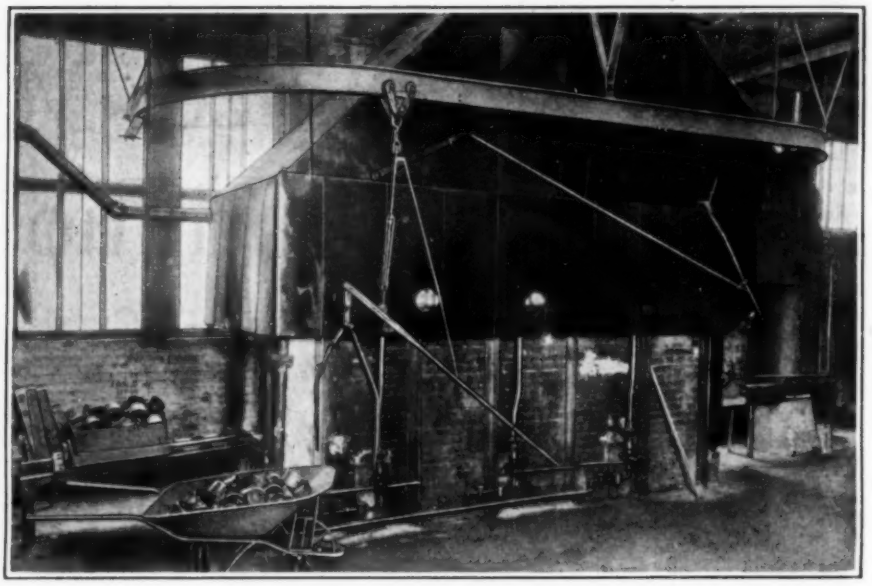


Fig. 2—General view of the annealing furnace

Fig. 3—Air cylinder for loading trays of shells.

Fig. 4—Unloading a charge of annealed shells

that the tongs can easily be transported from the loading end to the unloading end.

The loading end of the furnace is shown in Fig. 3, and in Fig. 4 is illustrated an annealed charge being removed from the unloading rack. As will be seen, the furnace has a ventilating shield surrounding it so that the fumes and the smoke will pass out of doors. Another feature is the compound operating handle for the doors, shown in Fig. 2, which is arranged to open and to close both doors simultaneously. The furnace was designed by W. J. Guyer, vice-president of the company.

Forty-Odd Years Ago

(From old numbers of the *American Machinist*)

A correspondent in Lowell, Mass., writes: "In this city the wages vary from $1.25 to $2 per day. A toolmaker or expert on the planer may get $2 per day if he fights hard for it.

The new foundry of the Westinghouse Air Brake Co., Wilmerding, Pa., is to run on the continuous molding plan. It has purchased the sole rights for the process in the United States.

For bringing flat, hardened surfaces to proper condition, the grinding machine will in the end find its place in the machine shop, but it is as yet but little used. The mechanical world has rested satisfied with the planing machine, but milling and surface grinding will eventually be used to supplement its operation.

The Pond Machine Tool Works, Plainfield, N. J., signed a contract for ten 96-in. lathes to go to Watervliet Arsenal for the manufacture of 8- and 10-in. guns. There are but four concerns in the country prepared to do such heavy work, and only two put in regular bids. The others offered lathes of their own design.

The technical education man asserts that apprenticeship as a system is dying out, and that the technical school must take its place. Perhaps so, but no scheme of a school which can be a substitute has ever been formulated.

A practice followed on lathes at the Gould & Eberhardt shop is to have the Vees covered with a brass shield which moves along with the slide rest and protects the ways from being scored by chips or other foreign matter.

Details of Jigs and Fixtures

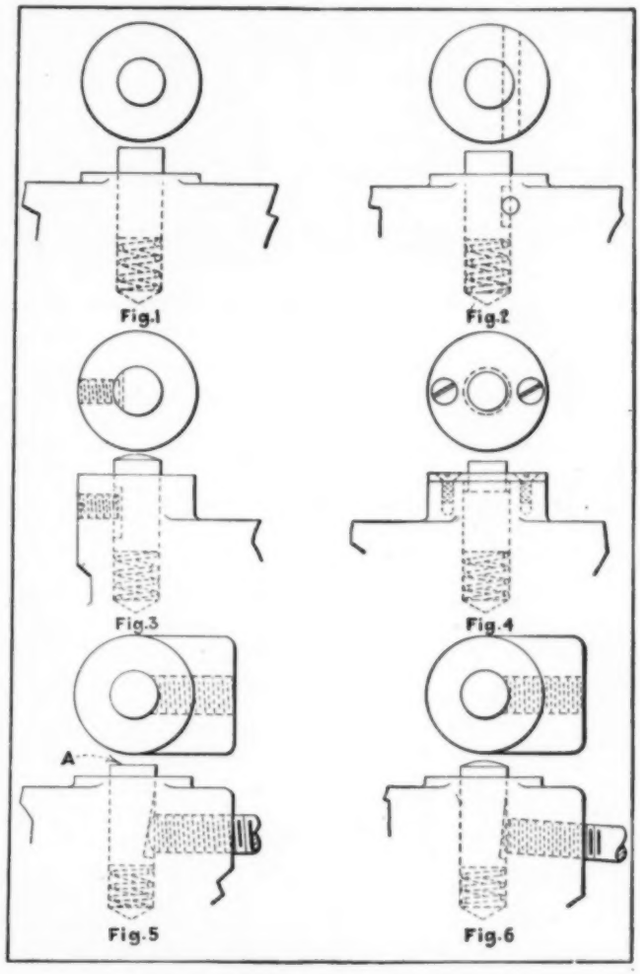
Design of Spring Pins

By J. A. Potter

Extra support is often needed for the work after it is in the fixture—This is supplied by properly designed spring pins—Details of several types of pins are given here

SPRING pins, sometimes called spring plungers, are used under several different conditions in the construction of jigs and fixtures. The usual purpose is to provide an extra support after the part is properly located and strapped down in the tool, the spring pin in this case being then released and locked in position through suitable methods. Extra care should be taken by the designer to have no more spring pins in a jig or fixture than are necessary. This is due to the fact that an operator, working on piece work, and not properly instructed and carefully watched, will often endeavor to set the spring pin in position and not operate it, thus giving him a shorter loading time and increased pay. Much spoiled work can be traced to this condition. Therefore, a foreman in receiving a new tool for try out should either have the spring pin removed if unnecessary, or instruct his workmen that it is placed in the tool for a purpose, and insist that it be used as instructed. The spring pin shown in Fig. 1 is of simple construction, and although it is not locked in position and can pop out of its hole, it has many uses. Fig. 2 shows the same type of pin with a slot cut in the side and either a taper pin or straight pin driven through the wall of the boss, permitting it to move up and down. A similar construction is shown in Fig. 3, a headless screw being used in place of the taper pin. A shoulder spring pin with a washer is shown in Fig. 4. It needs little explanation. The washer is held down by two screws and keeps the spring pin in place. The pin illustrated in Fig. 5 has an angular flat against which a screw or plunger is forced. This flat keeps the pin from turning and popping out, and when tightened will also withstand a pressure applied at point *A*. The plunger in Fig. 6 differs from that in Fig. 5 in that the screw or plunger is positioned at right angles to the angular flat on the spring pin. This spring pin is used more than any other type in the construction of jigs and fixtures.

Spring pins sometimes have a reduced shoulder upon which parts can be located, as shown in Fig. 7, the spring pin locating and holding the work in position at the same time. A jig or fixture is sometimes constructed so that a deep hole for spring and pin cannot be used. To overcome this difficulty, the spring pin can be constructed as in Fig. 8, by having a larger diameter of pin, the inside of which is drilled out to accommodate the spring. Another method is to drill the hole straight through the bottom of the wall of the jig, using a flat spring as in Fig. 9. The type shown in Fig. 10 has a notch on the pin in which a flat spring engages. The three types of pins are used only when it is not convenient to use a longer pin. It is frequently necessary in jig construction to support a part, and have the point of the drill run through the center of the spring pin. For this purpose some designers use a construction as shown in Fig. 11. This construction is not recommended, as chips from the drilled work will fall through the hole in the spring pin, and clog up the spring, thus stopping its action. A better type of spring pin is shown in Fig. 12. In this case the spring



Figs. 1-6—Simplest types of spring pins

The fifth article. The sixth will appear in an early issue.

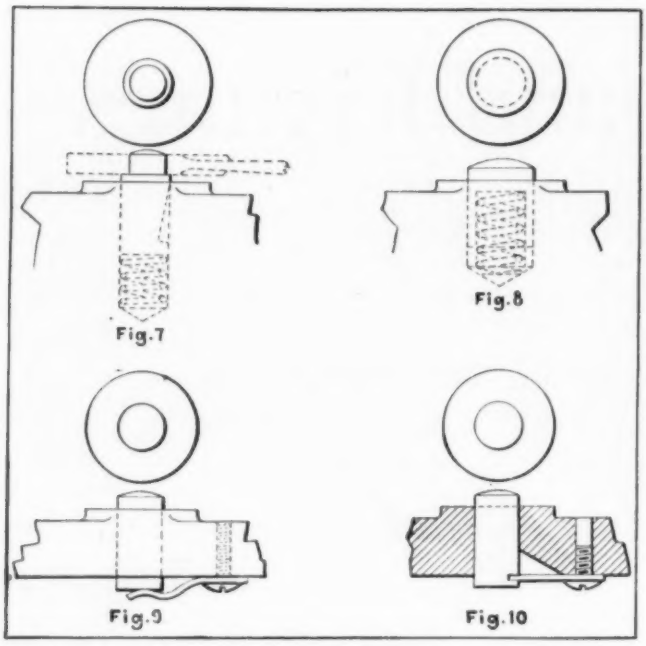
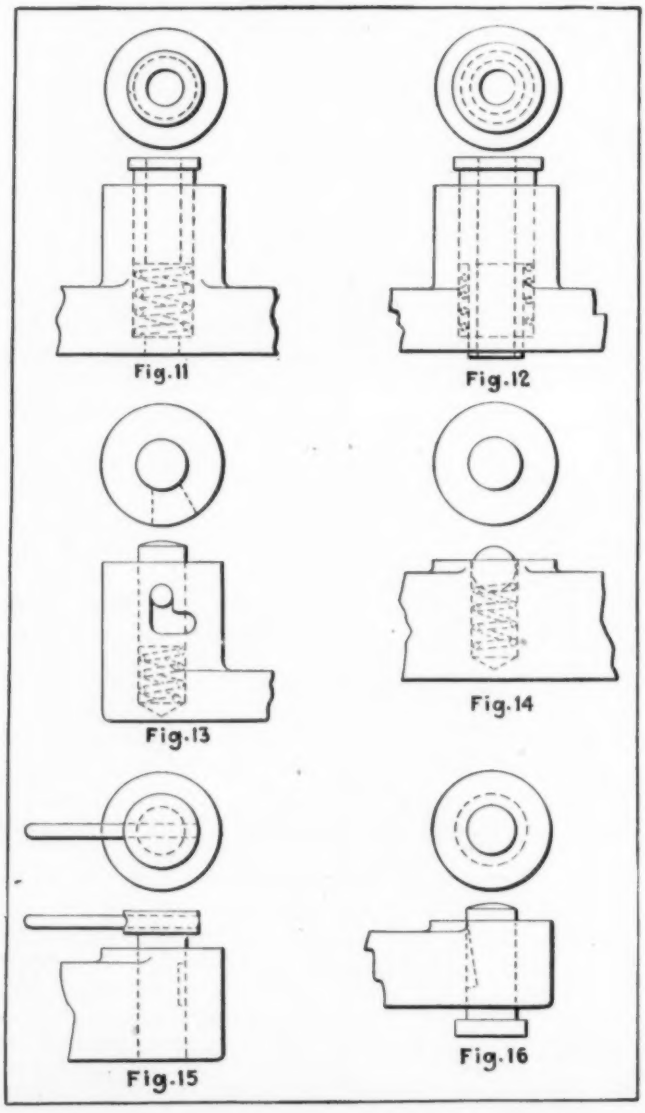


Fig. 7—Pin with shoulder for locating the work. Figs. 8-10 —Springs employed for shallow holes



Figs. 11-16—Various types of spring supports

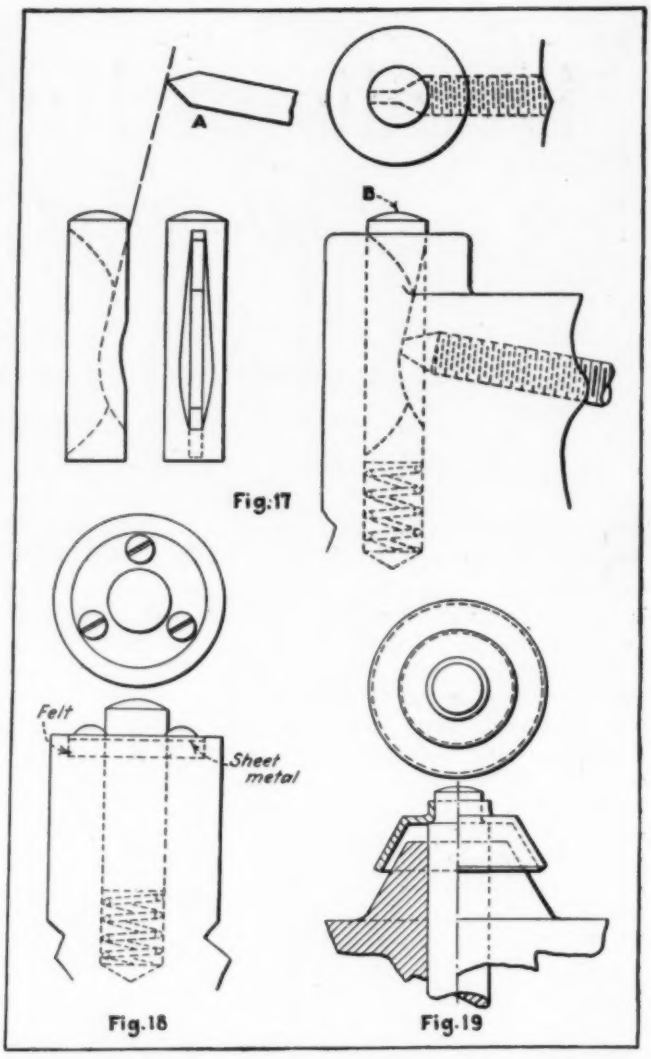


Fig. 17—Spring pin to support a heavy load. Figs. 18-19— Pins with protection from chips

pin runs through the bottom wall of the jig, and is located in a counterbored hole.

In Fig. 13 is shown a plunger with a small pin driven or screwed into it at right angles, the small pin acting in an L-notch. This is similar to a bolt action, and the plunger can be kept out of place when not wanted.

A hardened steel ball is sometimes used in place of a spring pin, especially with the type of stop shown in Fig. 4. The construction of this plunger is shown in Fig. 14. In Figs. 15 and 16 are shown pins without springs, the pin in Fig. 15 being lifted by a small pin driven into the head, and the one in Fig. 16 being pushed into place.

Spring pins for heavy work often have to withstand a considerable load. The ordinary angular flat as shown on the other pins would not stand up under this load, and consequently another method has to be employed as shown in Fig. 17. The pin is milled on an angle with a vee cutter, *A*, and the pin has a slot milled through it from the opposite side. A hardened taper-point screw of the same angle as the cutter engages the angle cut, this screw stopping the downward thrust from direction *B* by spreading the pin against the walls of the hole.

Spring pins for heavy work in cast iron have to be protected against the cast-iron dust as shown in Fig. 18. The cover shown in Fig. 19 is used under similar conditions, but has a shoulder head and a sheet metal guard which keeps the chips away from the spring pin bearing.

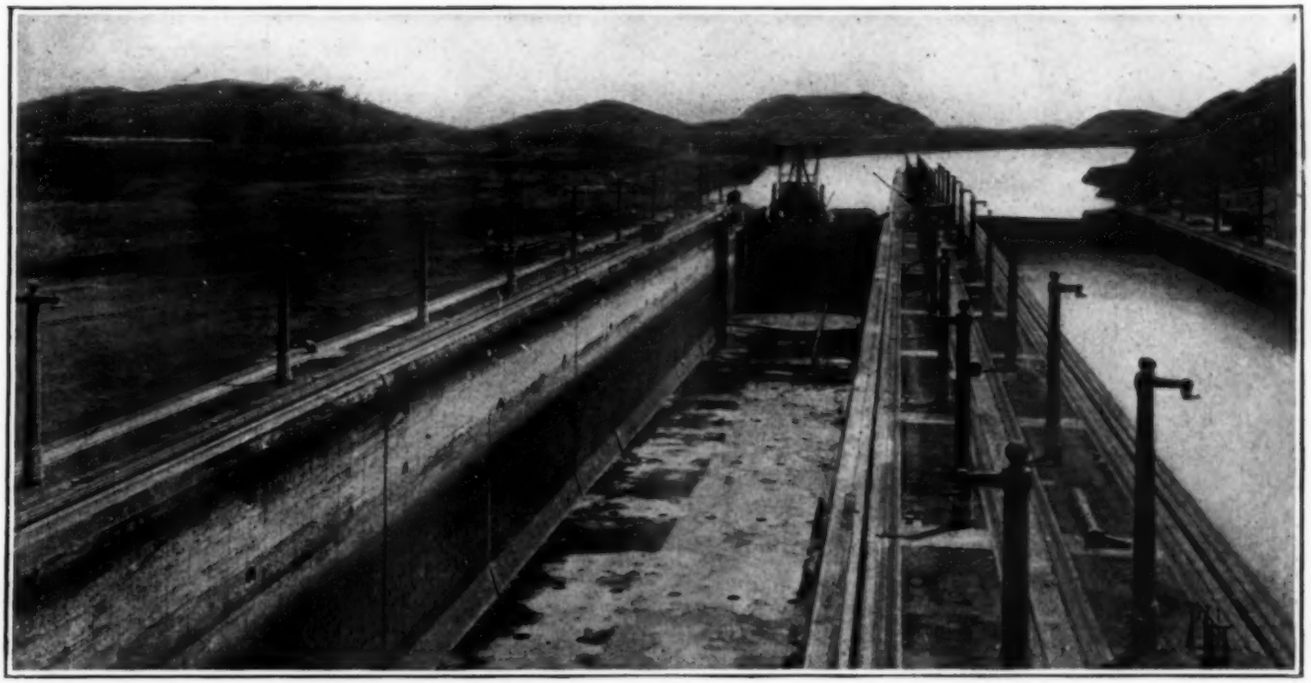


Fig. 1—A portion of one of the locks "unwatered" for repairs

Maintenance Work on the Panama Canal Locks

By FRED H. COLVIN
Editor, American Machinist

AWAY back in 1911, while the Panama Canal was being dug and popular interest was confined to reading about "making the dirt fly" the *American Machinist* realized there was much of interest and value to those engaged in the building of machinery of various kinds. It was my privilege to visit the Canal Zone at that time and to spend considerable time in the shops that made the digging of the canal possible. For back of the great steam shovels, the unloaders, the many locomotives and cars used in hauling the millions of cubic yards of "spoil" out of Culebra and other places, to the great Gatun dam and elsewhere, were the shops and the men to keep the machines that dug and that transported the material, on the job.

While the popular writers of the day aroused and maintained interest in the digging, the men and the shops that made the digging possible, were hardly considered. Few appreciated the fact that the railroad used in handling the material compared in many ways, such as mileage, locomotives and cars, with the well-known Boston & Albany R.R., now a division of the New York Central Lines. Or that more than 3,000 men were employed at the Gorgona and Empire shops to keep the locomotives, cars and steam shovels in working order. The sites of both these shops are now covered by the waters of Gatun Lake, which covers more than 160 square miles.

The maintenance of the locks is a real problem and it was a privilege, on a recent visit to the Canal Zone, to get a glimpse of what it means to operate them and to keep them in operation. Fortunately for me, one side of the Gatun locks was "unwatered," or undergoing repairs, at the time of my visit, so that I had the opportunity of going down into the locks and through the great culverts, wearing hip boots supplied by H. M. Thomas who accompanied me. Mr. Thomas is the Assistant Superintendent of these locks and, having been there since construction days, is thoroughly posted on all details.

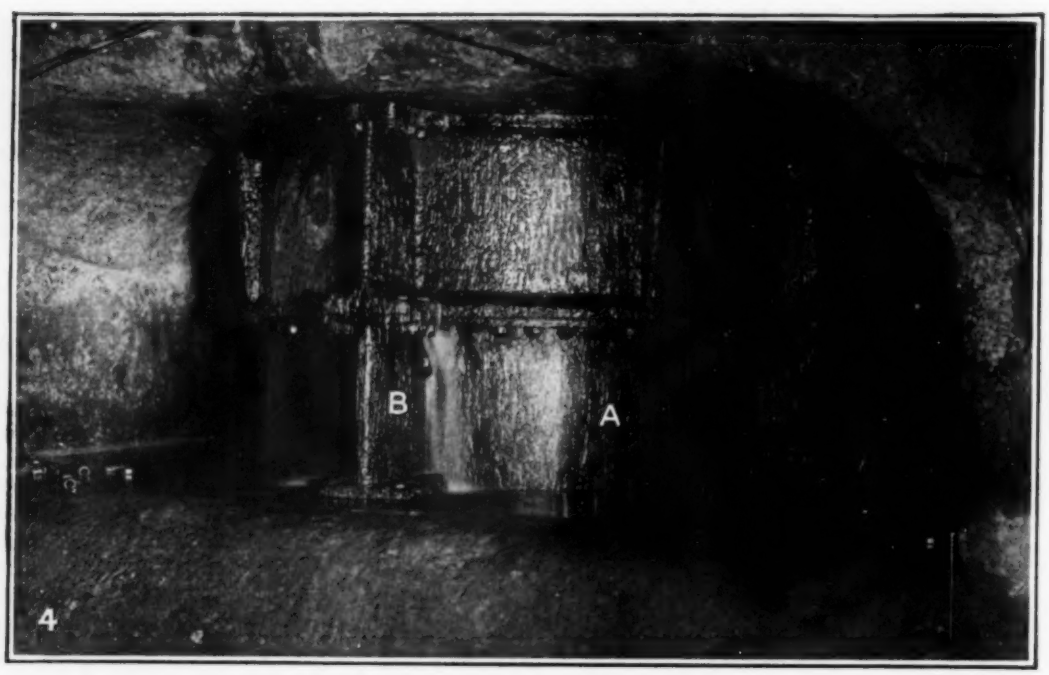
The designers of the operating mechanism, such as the valves controlling the flow of water in and out of the locks, did not, and probably could not, foresee the effects of wear and of corrosion. Then, too, there are the barnacles and other sea growths that attach themselves to the huge surfaces of the steel gates next to the ocean. The action of the fresh water from the lakes, the sea water at each end, and the mixture of the two in the center locks, present three different problems in the care and protection of the metal in the gates.

The first article. The second will appear in an early issue.

Fig. 2—An opening in the center wall to reach the culvert. This opening admits the passage of men and material for inspection and repair to the huge culvert in the center wall, through which the water comes to supply the locks. This opening is closed and sealed after the repairs are made

Fig. 3—Inside one of the 18-ft. center culverts. These culverts are the same size as those used by the Pennsylvania Railroad for its tunnels under the Hudson and East Rivers. At Gatun this culvert is something over a mile long

Fig. 4 — One of the valves for filling the locks. These valves are set in the openings shown in the side of the culvert in Fig. 3. They are 7 ft. in diameter and are operated from above by an elaborate but thoroughly reliable system of remote control. The lower part of the valve raises to permit the water to flow to the locks when so desired



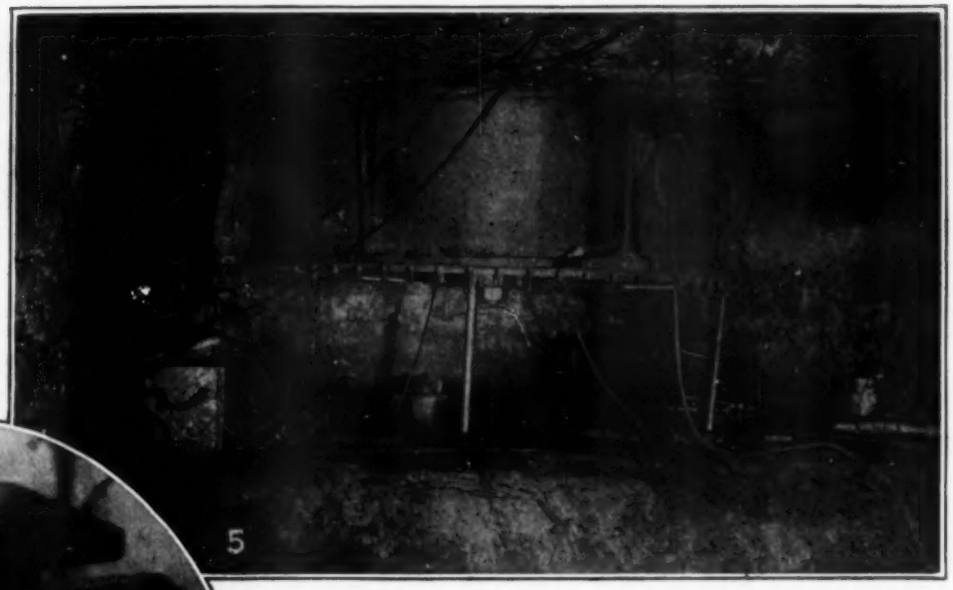


Fig. 5 — Valve with pedestal removed. The lower portion of the valve has been taken out to permit the seat to be re-faced, and the guiding surfaces to be renewed if necessary. One of the supports in the valve-seat casting can be seen at the back of the lower part of the opening

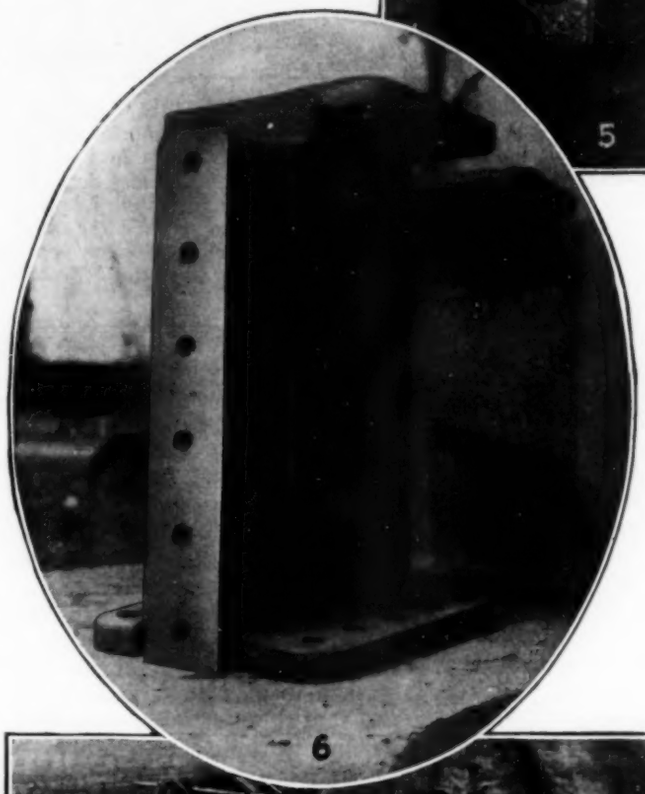
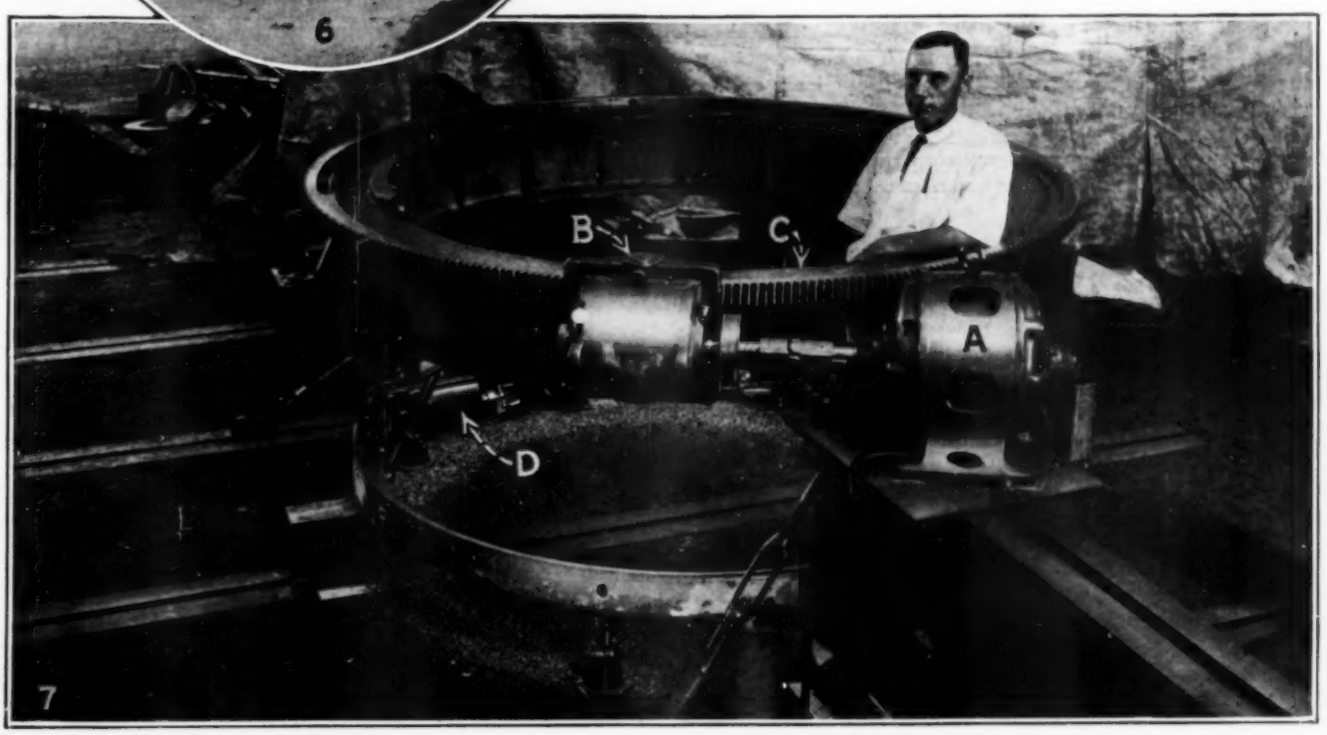
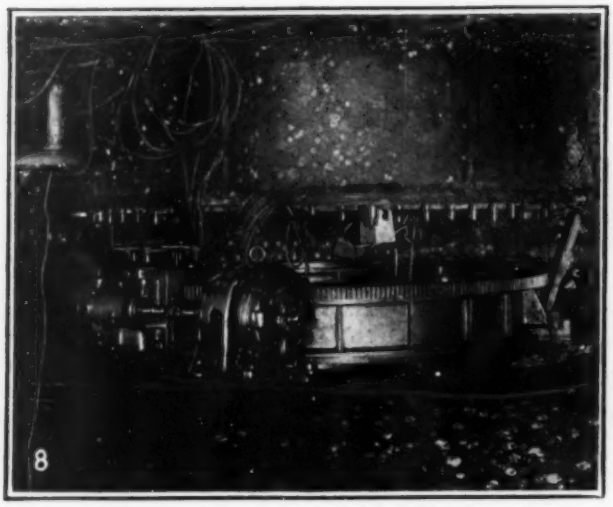


Fig. 6 — One of the guides with a renewable shoe. This is one of the many improvements made in the construction of the apparatus used in connection with the locks, by the engineers in charge of maintenance. Where it was formerly necessary to replace the entire guide, it now means a new face only

Fig. 7—Valve-seating machine set up in the Balboa shop. This machine was suggested and devised by the maintenance engineers in connection with John F. Phillips, master mechanic, who is shown inside the machine. With this machine, it was possible to bore the valve-seat casting to receive renewable seat rings





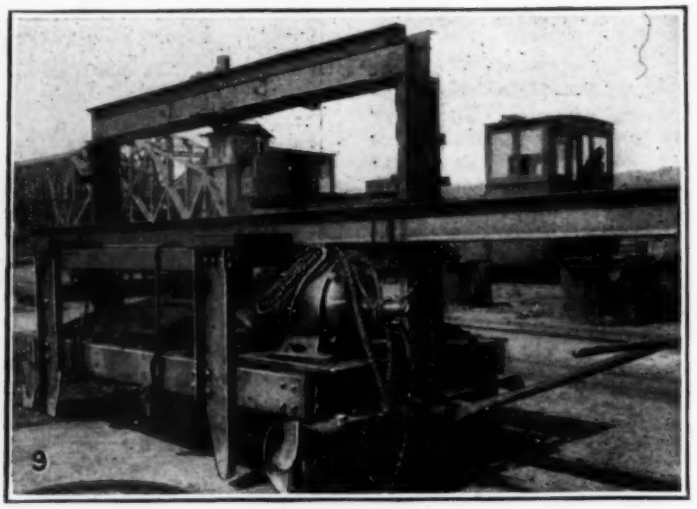


Fig. 8—The machine in place, refacing a valve seat that is in the side wall of the culvert. This view gives an idea of the close quarters that had to be considered in designing this machine, and in which it must be handled. It requires considerable skill to handle this machine in and out of position, but the men on the job are sufficiently experienced, so that nothing of this kind delays the progress of the work. Fig. 9—Chuck for handling valve seating machine in the culvert. This chuck was built especially to help overcome the difficulty of handling the valve seat facing machine in the contracted quarters of the culvert. The machine goes through the opening in the side wall, shown in Fig. 2, and can then be drawn to any desired valve opening. The projecting I-beam enables the workmen to slide the machine in position so as to clear both the valve and the concrete beneath

The problem is made more difficult because the gates are in constant service for at least three years, and the overhaul or repair period is now being extended to four years. New protective coatings are constantly being tested in the earnest endeavor to find those best suited to the different conditions. But unlike most mechanisms, wear or corrosion cannot be watched constantly, since the gates and the control valves are under water at all times except during the repair periods. It is because of the lessons learned and the improvements made by the maintenance engineers, that it is now possible to extend the time between overhauls from three, to four years.

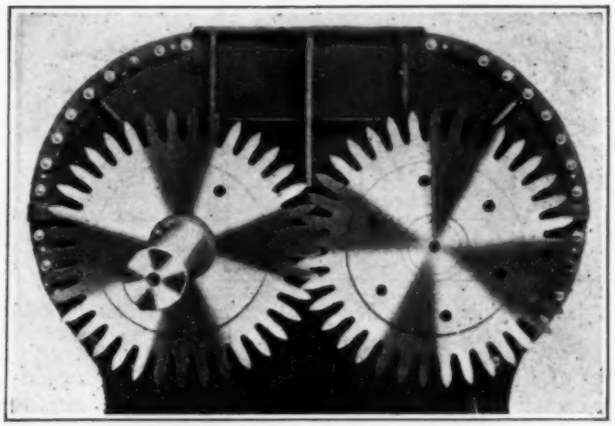
A little idea of the size of one of the locks can be had from Fig. 1, especially if the reader can pick out the group of men to the right of the pipe line near the far end of the lock. In Fig. 2 is shown a close-up of an opening into the center wall through which we climbed to get into the great culvert shown in Fig. 3. Both views show the need for hip boots. This culvert is 18 ft. in. diameter—the size of most railroad tunnels for locomotives and trains. It is through the opening in Fig. 2, that the valve-facing machines and new parts for the valves, gain access to the culvert. The openings in the side walls are the pockets that hold the large round valves that control the flow of water into the locks through the holes shown in the bottom in Fig. 1. One of these side openings with the valve in place, and closed, is shown in Fig. 4. This valve is 7 ft. in diameter and is normally under water when the culvert is full. The portion *A* is raised to open the valve, *B* being one of the guides. One of the guides, improved by the addition of a removable and renewable shoe, is shown in Fig. 6. In Fig. 5 the guides and movable part of the valve have been removed to permit the refacing of the valve seat by means of a special, portable machine. Office engineer E. S. Randolph is credited with its design, aided by suggestions from John F. Phillips, master machinist of the main shops at Balboa, Canal Zone, and others.

The machine itself, with Mr. Phillips inside it, is shown in Fig. 7. This view was taken in the shop, with the machine set up to show its operation and also its size. The motor *A* drives a pinion on shaft *B*, through suitable gearing in the case, and turns the large geared ring *C* that carries the cutting tool in the tool slide *D*. A renewable ring valve-seat is shown just beneath the cutting tool, this ring being one of the improvements made since the installation of the valves. This same machine was used to bore out the valve-seat casting to receive the renewable valve seat.

The machine is shown in place refacing a valve seat, in Fig. 8. This view gives an idea of the condition of the concrete due to sea growth. In spite of the cramped quarters and the fact that men are working under abnormal conditions, the repairs are made much more rapidly than seems possible when all the handicaps are considered. But it takes real mechanics and real supervision by men who know the canal work. Many of the executives have been on the canal since the construction days, and the rest have given years of service. The personnel is of a very high type.

For handling the valve-seating machine in the culvert, the rig shown in Fig. 9 has been built up. This device goes into the opening shown in Fig. 2, being handled from a crane on the upper wall of the locks. With it the seating machine can be taken to the opening in the wall and slid into position much more rapidly than might be imagined. The devices described have been of great value to the canal, both as to reducing the costs of repairs and also in avoiding the necessity of tearing out the old valve-seat casting when the seat becomes worn too badly to use. The replaceable seats and guide shoes also have proved their great value. And the men on the job are keenly alive to the possibilities of still further increasing the efficiency of the various mechanisms under their control.

Some who have spent time and money in training apprentices feel that the commandment "thou shalt not steal" applies to apprentices as well as to material commodities.



A New Flexible Gear Tooth System

By JOHN T. WILKIN
President and Engineer, The Connersville Blower Co., Connersville, Indiana

Smooth, silent operation at high speed claimed for this modified tooth form of unconventional design—Has an extended root of parabolic form and extended addendum with a rounded point

GENERAL practice in the commercial design of gears with involute and cycloidal teeth has been to design the teeth for great strength and rigidity. As a consequence it has become the practice to design and proportion the teeth so that, during the major portion of the time, the entire transmission of power is through the medium of a single pair of teeth, a second pair coming into action only slightly before the first pair passes out of action. In the commercial production of such rigid teeth, certain standards have heretofore been adopted as to the practical radial extent of the addenda and the consequent necessary radial extent of the dedenda and roots. In the establishment of such standards, the radial extent of the addendum has been limited, because it was found that with rigid teeth too great an addendum produced too much sliding under high pressure, thereby resulting in the production of undesirable heat and difficulties of lubrication, as well as abnormally short life.

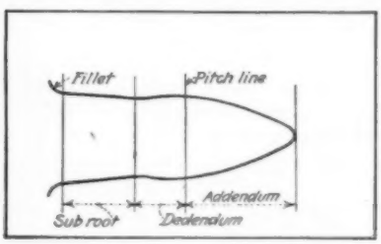


Fig. 1—The Wilkin flexible gear tooth form has an extended addenda and a root with a radial dimension considerably greater than what is needed merely for clearance, as Fig. 2 indicates

Some attempts have been made to produce gears of the rigid type in which two or more pairs of teeth would at all times be in contact, but it was found that the required accuracy of both contour and spacing of metal teeth for multiple contact at high speed was not attainable by commercial methods. The tendency within recent years has been toward the more rigid single-contact tooth construction, such as obtained by shortening the teeth. Gears so formed are very rigid and require a high degree of accuracy in production. It has been found by experience that small variations from theoretical accuracy, either of contour or of spacing, result in the transmission of impulses at the higher speeds that cause breaking of contact during operation. This action produces noise, destructive hammering, and pitting of the faces of the teeth. The intensity of such impulses increases as the square of the speed, and hence limits high-speed operation.

In order to transmit power through a set of gears with less noise, more uniform angular velocity, and under better conditions of lubrication than usual, a modified tooth form of unconventional design was recently developed and patented. In the new system, the working faces of the teeth are formed with the usual odontic curves; that is, the teeth of mating gears can be either both involute curves or both cycloidal curves. The thickness of the teeth at the pitch line can be substantially decreased below present recognized standards of strength for a desired load, because a larger number of teeth bear the load. The addenda also are radially lengthened, substantially beyond present accepted standards, in order that three or more pairs of teeth will be in action at all times. The addenda, at their tips, are relieved slightly from theoretical in order to eliminate a sharp edge that would cut into the oil film on the approaching tooth. The dedenda are inwardly extended to correspond and to allow proper action with the extended addenda of the mating teeth. The tooth is supported by a root having a radial dimension considerably greater than what is needed merely for clearance. This extended root is so formed as to be a part of a cantilever beam of approximately uniform strength. If the outlines of the beam were extended into the tooth, they would fall entirely within the contacting portion of the tooth.

At the junction of the extended root with the gear body there is a rounded fillet of usual form to avoid rupture. In Fig. 1, a typical flexible tooth form is shown.

In practice it was found that the addendum of the

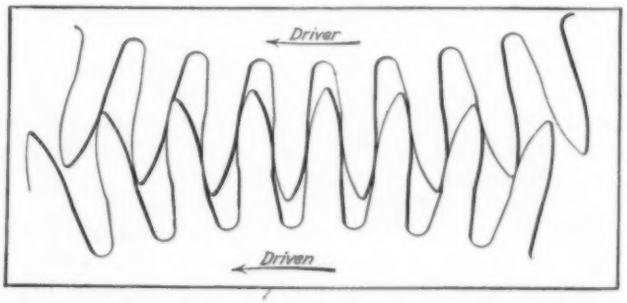


Fig. 2—Normal contact conditions of gears having the flexible tooth form with five pairs of teeth in contact

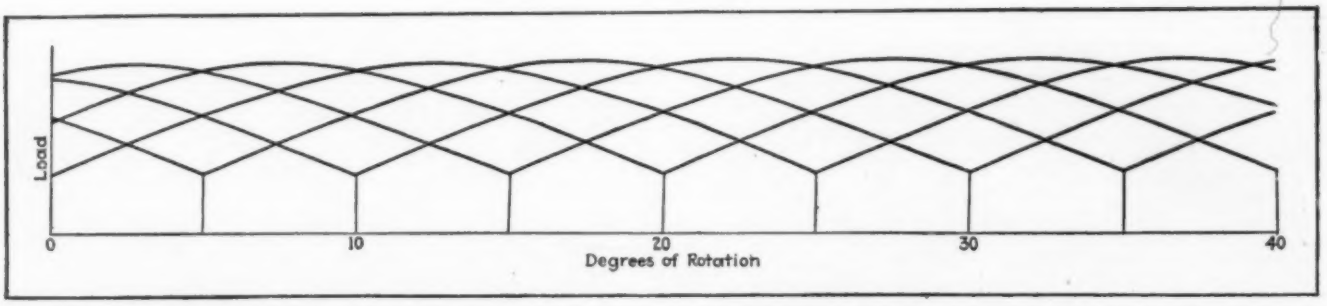


Fig. 3—Chart showing the calculated variation of pressure on flexible gear teeth when five teeth are in contact

tooth could actually be extended to its limit, that is, the point where the addendum curves intersect. The tip of the power-receiving tooth should not be a sharp corner, however, but should be rounded or relieved slightly. In other words, the power-receiving face at the end of the driven tooth should not cut the film of oil that lies upon the driving tooth, but should be so formed that, just as the teeth come in contact, the approaching surfaces will be substantially parallel, thus providing as much area as possible, between which a film of oil will be entrapped, instead of being ruptured and scraped away.

The extension of the root is sufficient to make each tooth capable of a circumferential yield, under load, equal to the unavoided departure from theoretical accuracy as to contour or spacing. Each pair of contacting teeth, if their combined error makes them more prominent than they should be, is capable of yielding to such an extent that the actual departure from theoretical accuracy at the point of contact is compensated by this yield. Furthermore, the excess pressure required to produce this yield is not sufficient to break contact completely between the adjacent contacting teeth. In Fig. 2, for example, five pairs of teeth are shown in contact.

The deflection of a cantilever beam at the point of application of a load varies as the cube of the distance between the fixed point and the point of application; consequently, the resistance to deflection of a tooth will vary approximately as the cube of the distance between the base and the point of application of the load. The calculated variation of pressure on each tooth in all positions is shown diagrammatically in Fig. 3. The total load is the summation of loads carried by each of the five pairs of teeth.

The circumferential yield of each tooth is distributed as uniformly as possible throughout the length of the tooth and its extended root so that there is no local concentration of fiber stress that might result in an ultimate rupture of the tooth. The length of the extended root is such that at the moment when any driven tooth comes into action at its top, it shall be incapable of bearing a pressure high enough to impart or cause a shock or change of angular velocity of the driven wheel. On the contrary the tooth yields to such an extent that the application of load is gradual. Here, the advantage gained by relieving the tips of the addenda of the receiving faces of the teeth of the driven gear becomes apparent, as it is in this position that each receiving tooth will offer the least pressure resistance.

It will be observed that the mass of metal near the top of the tooth is very small. Hence any shock due to mass resistance at the time of initial contact will be slight. This virtual elimination of mass resistance, combined with the flexibility of the teeth, will allow initial contact to occur without noise and without shock to the bodies of the gears. Furthermore, with a multiple number of teeth in contact and a resultant decreased intensity of pressure on the several teeth in contact, and because of the absence of shock and hammering, better lubrication is accomplished and the life of the gears is prolonged.

The illustration at the head of this article shows a practical application of gears having this flexible tooth form, to a Connersville lobe-type rotary pressure blower. Each gear has 37 teeth and a pitch diameter of 26 in. The face of the gears is 11 in. The contacting faces of the teeth are of epi-cycloidal form. An analysis of a pair of gears having this form of teeth shows their breaking strength to be greater than that of a pair of standard 14½-deg. involute gears of the same dimensions and number of teeth. It is believed that there are many applications where gears of this type can be used to advantage.

Modified Commendation

By Beecher Parkhouse
Fergus, Ontario, Canada

A CERTAIN manufacturing firm whose foundry is in a different town from its machining and assembling plant took occasion recently to commend the foundry superintendent for an improvement in the molding of one of its staple castings. The official whose duty it was to thus advise the foundry sent the following letter:

"How much better balanced our stormy old world would be if those who are ever ready to point out error would be equally eager to commend virtue and proficiency! Reflecting upon this I am moved to tell you in a few words that your castings, which were about as wretched a kind as artisans could produce, inspectors dared to tolerate, or a dubious public be induced to sign for, are now coming in very, very much better. This brief note is to advise you that we have observed and are grateful for the vast improvement in this commodity. We hope you will keep up the good work."

Marking Drill Shanks—*Discussion*

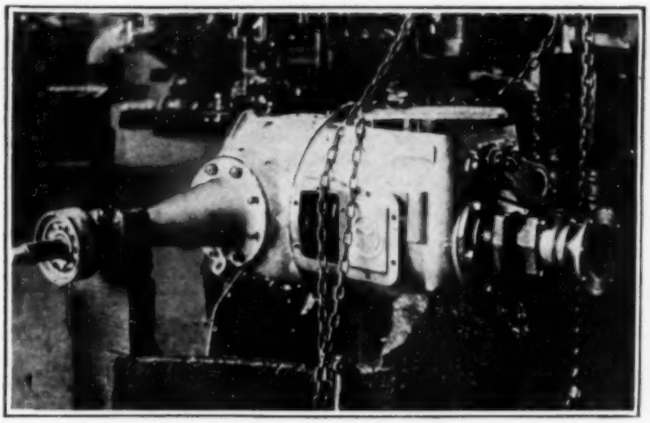
By John J. Kauffman

AS AN interested reader I cannot help but echo the sentiments of Edwin P. Anderson's article under the title given above, and published on page 508, Vol. 67, of the *American Machinist*.

Why in Sam Hill are drill shanks so marked that in the course of a few trips to the drill press, the stamping is often obliterated?

The drill maker who overcomes this difficulty will be doing us all a good turn and I hope that his drills will sell at a premium, as they deserve to.

Automotive Production



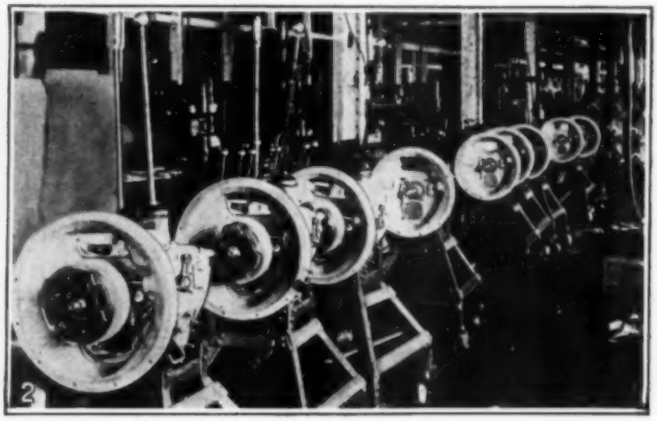


Fig. 1—Complete transmission unit before painting. Fig. 2—The assembly line

Glimpses of Mack Production

The machine shops at the New Brunswick plant

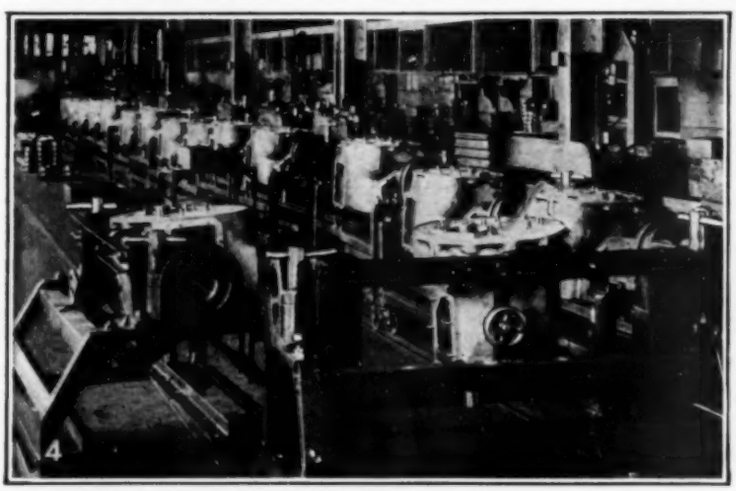
By S. J. KOSHKIN
Associate Professor of Machine Design, Cornell University

MACK trucks are made in models and in capacities of from 1½ to 7½ tons. Tractors are built in trailer capacities of from 5 to 15 tons. The trucks are made in various wheelbases, and the lighter models are made either with chain or dual-reduction drive.

The principal units produced in this plant are: Transmissions (both dual-reduction and chain drive) and steering gears for the various types of trucks and tractors.

The following departments are included: Bushing and punch press, shaft, automatic screw machine, shaft turning, gear blank, housing, maintenance and repair, laboratories (chemical and physical), heat-treating, gear cutting, chucking, grinding, and assembly.

The first article. The second will appear in an early issue.



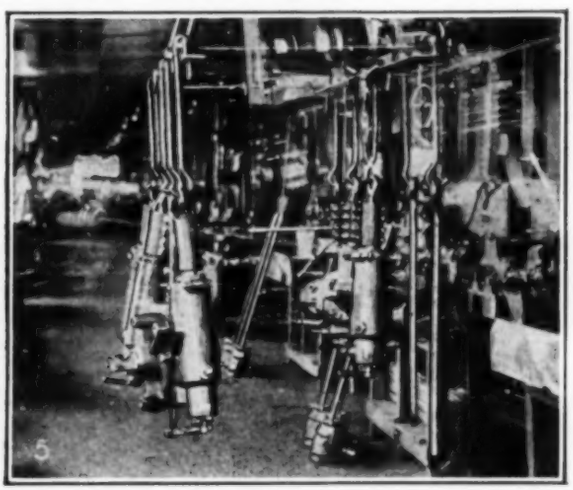


Fig. 4—The assembly line for another type of transmission. Transmission units for chain-drive trucks are assembled on carriages running on a track lengthwise of the building. The sub-assembly operations are carried out on benches to which parts are passed out from stock bins nearby.

Fig. 5—Steering gear assembly. The parts are hanging on a rack. After assembly they are painted and then carried to the shipping department

Automotive Production

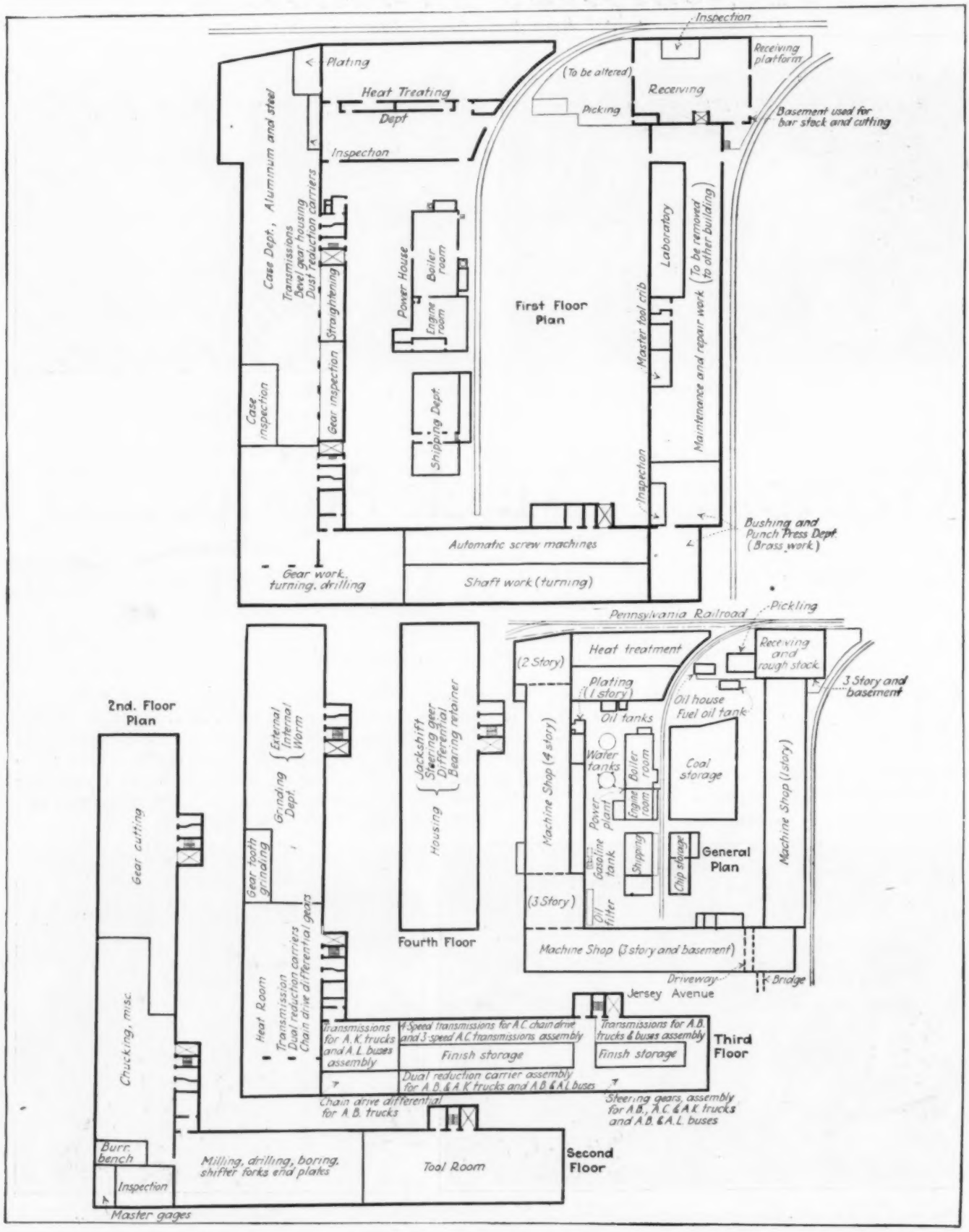


Fig. 3—The New Brunswick, N. J., plant of the International Motor Co. General plan of machine shops and plan of each floor showing the various departments

Automotive Production

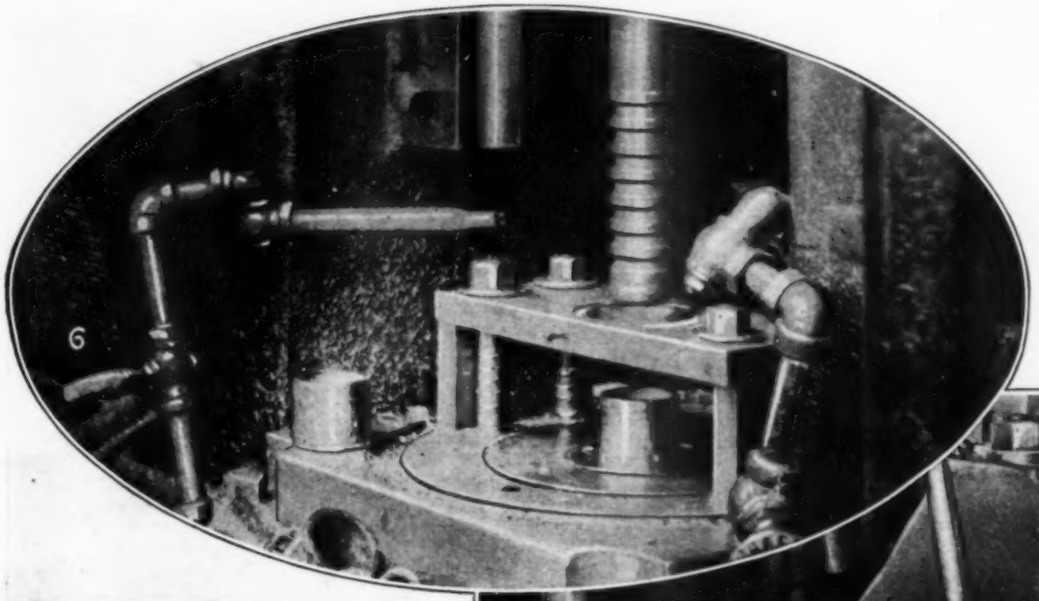


Fig. 6—Brake spider and cam bushings being broached. The operation is performed on a press. Over six hundred holes per hour are broached to within 0.001 inch

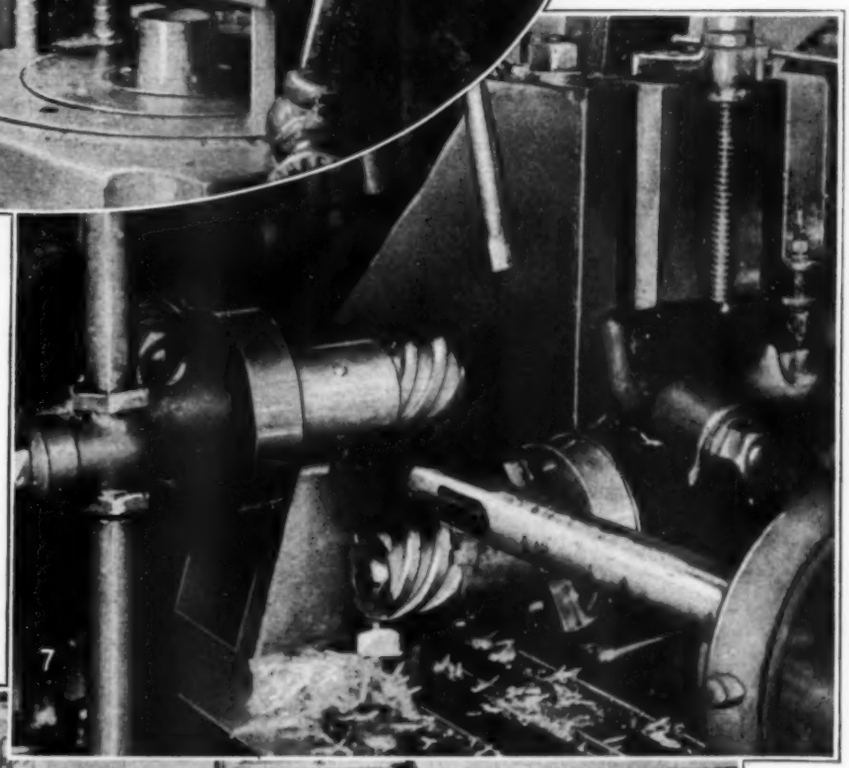
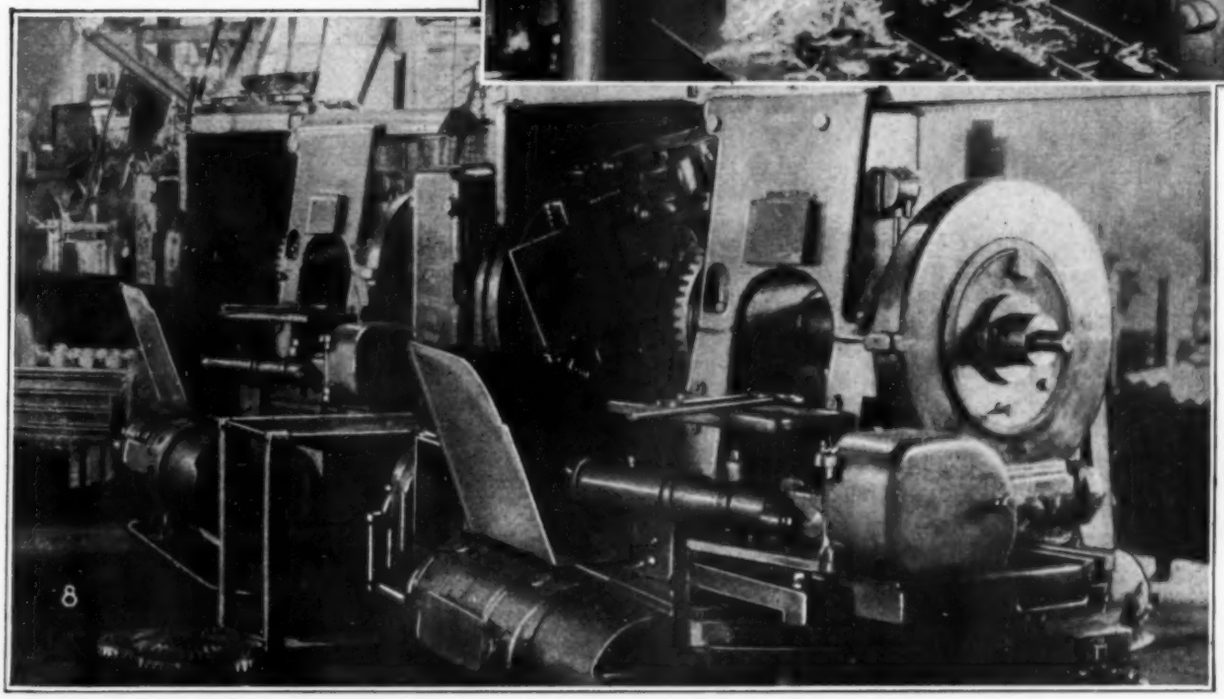


Fig. 7 — Milling square ends of jackshafts. Helical cutters, mounted in an 18-in. automatic milling machine, mill opposite sides at once, requiring but one indexing to complete the square

Fig. 8 — Finish-generating 42 teeth on driving bevel-gear in 50 min. on 25-in. generator. The machine makes 110 strokes per minute. Two other machines of this type are in use



Automotive Production

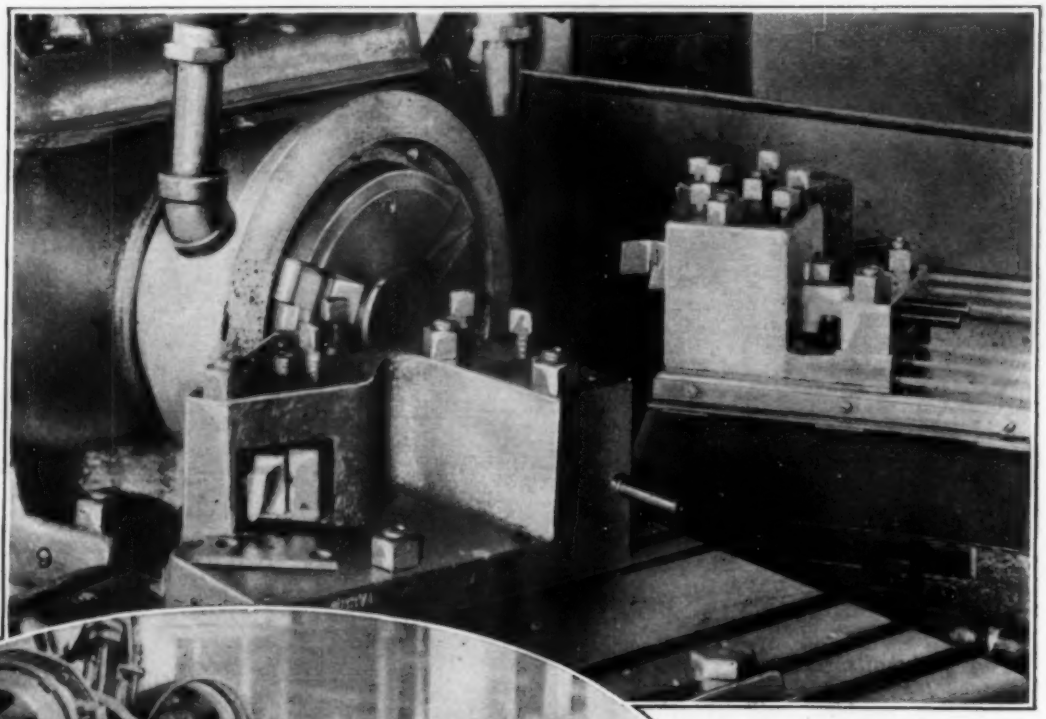


Fig. 9 — Turning twenty bevel-gear blanks per hour on a lathe. During the first operation all bevels are rough-turned and the chamfers are simultaneously rough-formed. During the next operation two other tools bring the work to a finish

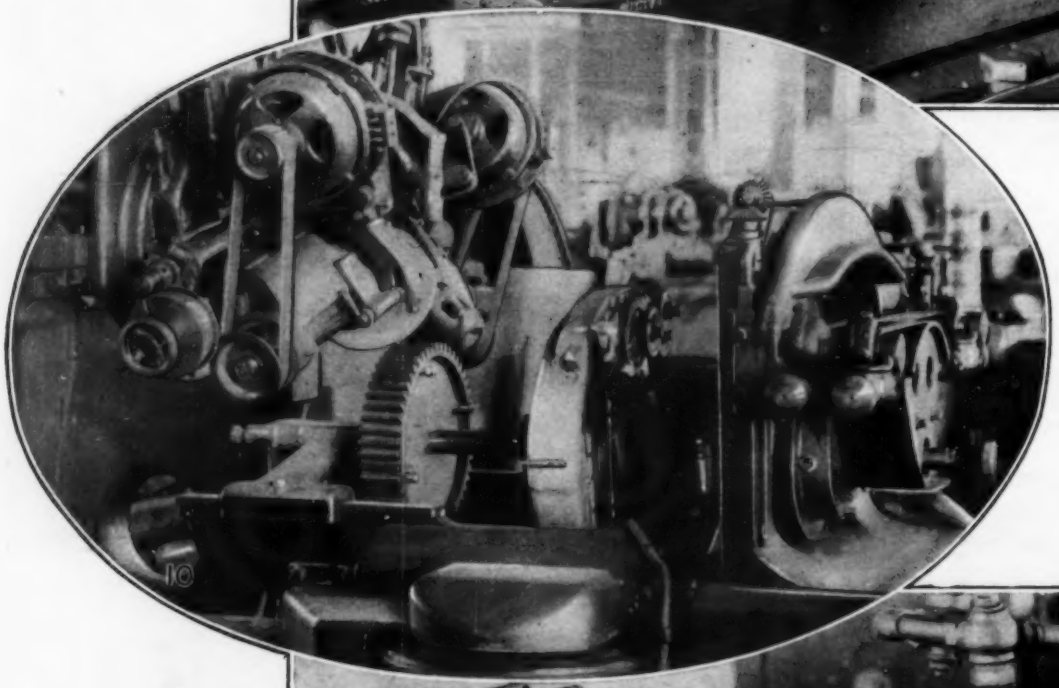


Fig. 10 — Finish-grinding 51 teeth, two gears at a time, on a gear tooth grinder. The stroke lever makes 55 strokes per min. The gears are ground to the highest degree of accuracy

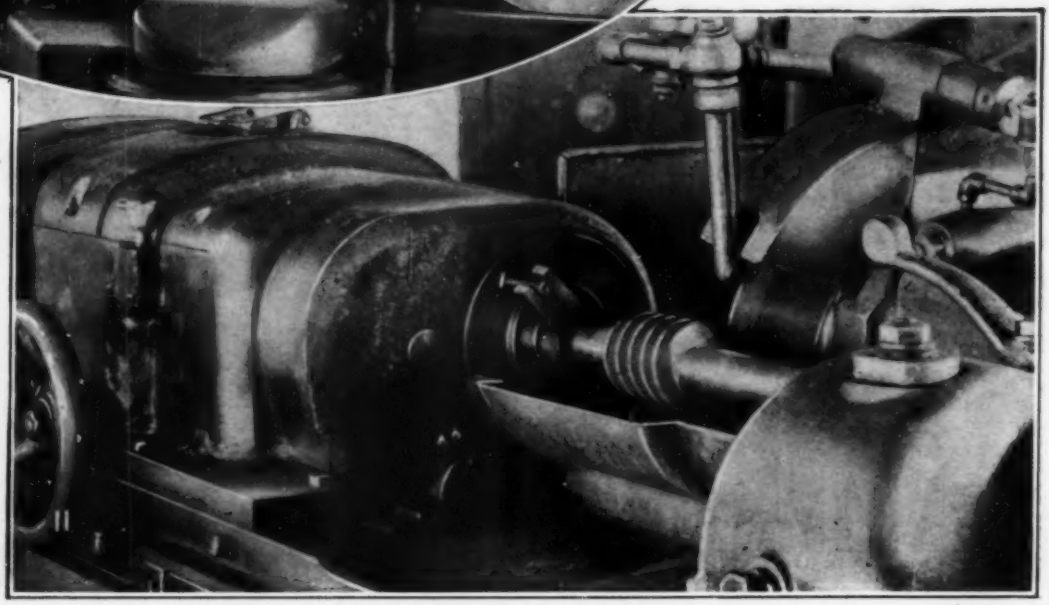


Fig. 11 — Grinding steering worms. The speed of the wheel is 1,845 r.p.m. and the work revolves at 80 r.p.m. The table traverse is 18 strokes per minute. From four to five worms are ground per hour

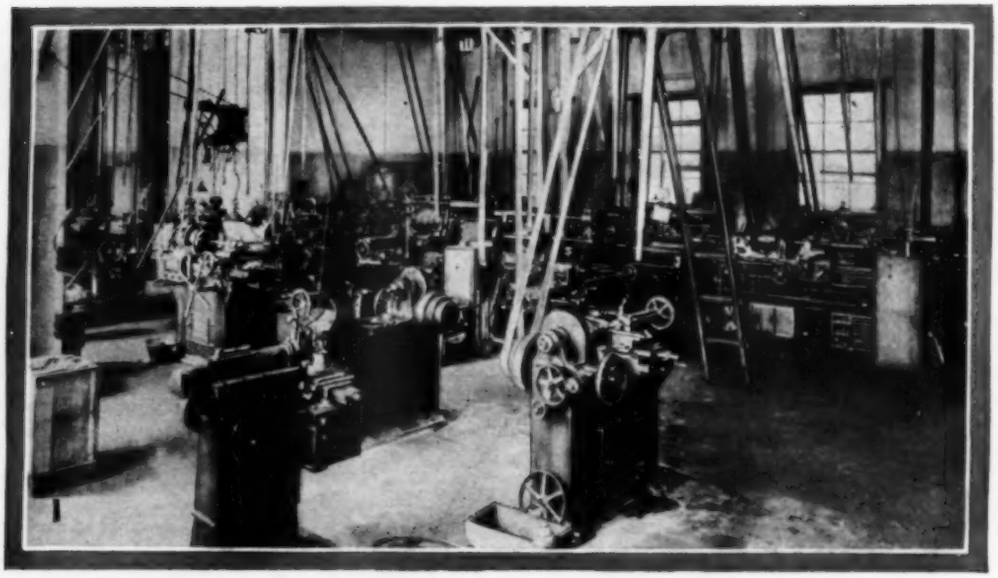


Fig. 1—Where cutters and gages are made. This view gives a good idea of the equipment used for tool work, which includes milling machines of various types, engine lathes, relieving machines, a small shaper and an internal grinder. All the machines are belt driven

Building Machine Tools in Japan

Photographs by courtesy of the Ikegai Iron Works, Ltd., Tokyo, Jajan

SOMETHING over thirty-seven years ago, Shotaro Ikegai, who is still president of the Ikegai Iron Works, hired two old, imported lathes in Tokyo, and started business in a small shop having an area of about 75 sq.yd. He built two more lathes. These two lathes were the first machine tools made in Japan. Increasing business demanded steady growth of his plant year by year. As a result of experience in manufacture, together with research and experimental study, the small shop has now become a large plant covering about five acres, nearly filled with workshops and other accessory buildings.

The Ikegai Co. is now the largest machine tool and internal-combustion engine works of Japan. The present plant is located in Shiba in the city of Tokyo, although the company has prepared for future extension by purchasing about fourteen acres of land near Tsurumi, a future industrial center between Tokyo and Yokohama.

The machine tool and engine departments are kept separate on account of the different types of accuracy required in the two kinds of work. During the war, over 1,000 men were employed but now the force is about 600, besides 160 men in the commercial and engineering staffs. The machine tool department makes a variety of machine tools as well as cutters, reamers and gages.

The oil engine department is about thirty years old and builds all sorts of engines using any variety of fuel, such as kerosene, gasoline, or heavy oils, up to 800 b.hp. for both land and marine purposes.

The shops are well equipped with about 450 modern machine tools. During the war 600 lathes were delivered to Russia, 80 to Mexico, and some to Great Britain.

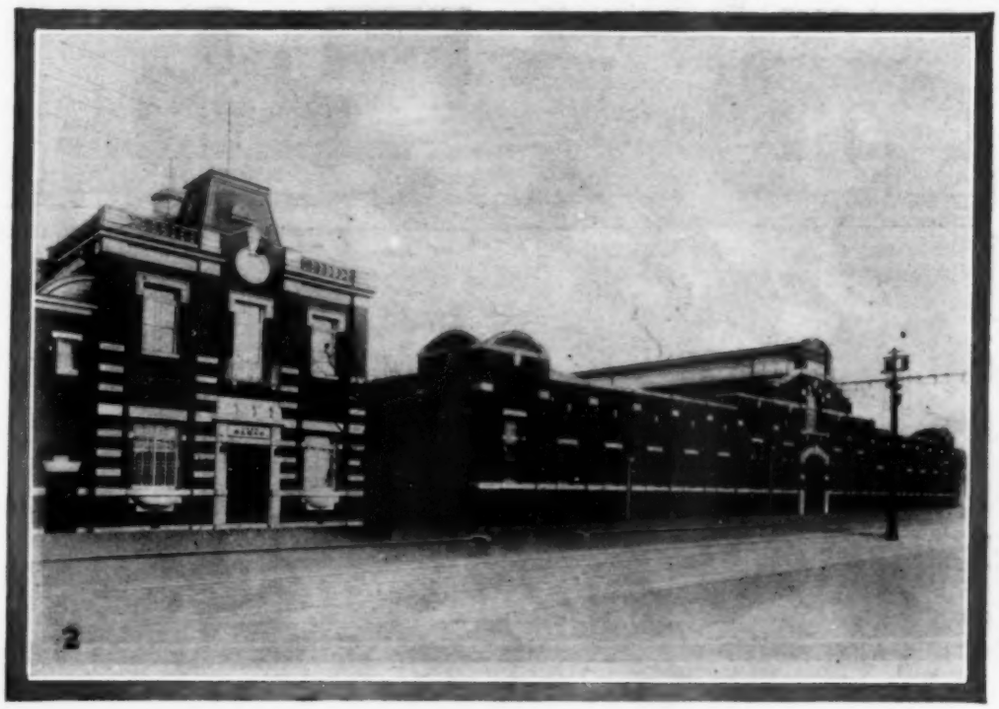


Fig. 2—Office and plant of the Ikegai Iron Works. The attractive architecture and substantial construction are clearly shown. The shop is of one story, with a high bay through the center for accommodating a traveling crane to handle large work. Light and air are obtained through the monitor over the high bay

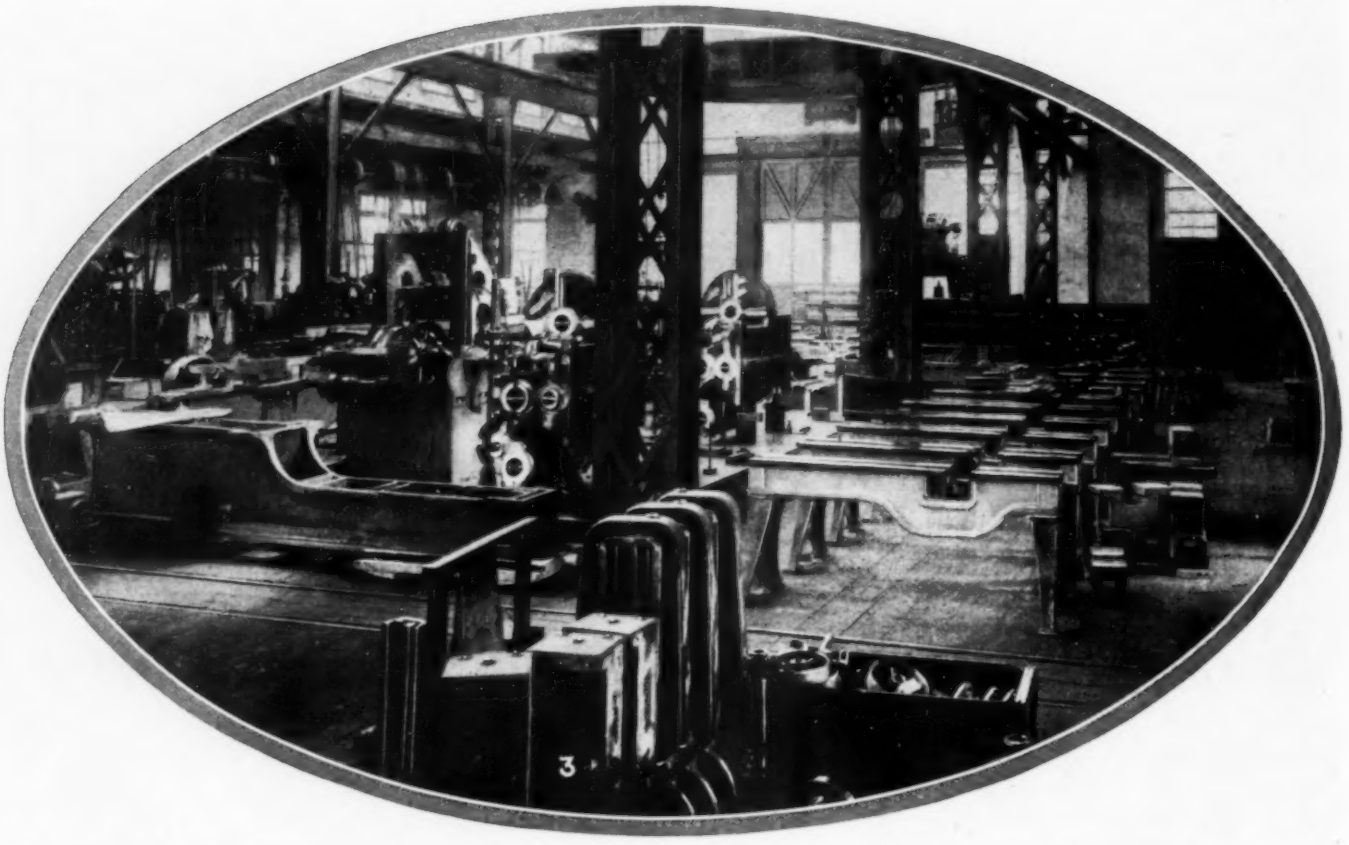


Fig. 3—A portion of the erecting floor for machine tools. This view gives a good idea of the variety of machines built, showing several comparatively small gap lathes at the right; the outer bearings for horizontal boring and milling machines in the foreground; and the bed for a machine that is considerably larger and heavier, at the left

Fig. 4—Some of the finished machines in the stockroom ready for shipment. This view gives a fair idea of some of the machines built, and also shows that they are not built on orders. As can be seen, the machines include lathes, milling machines, slotters, horizontal and vertical milling machines, horizontal boring machines, and grinders

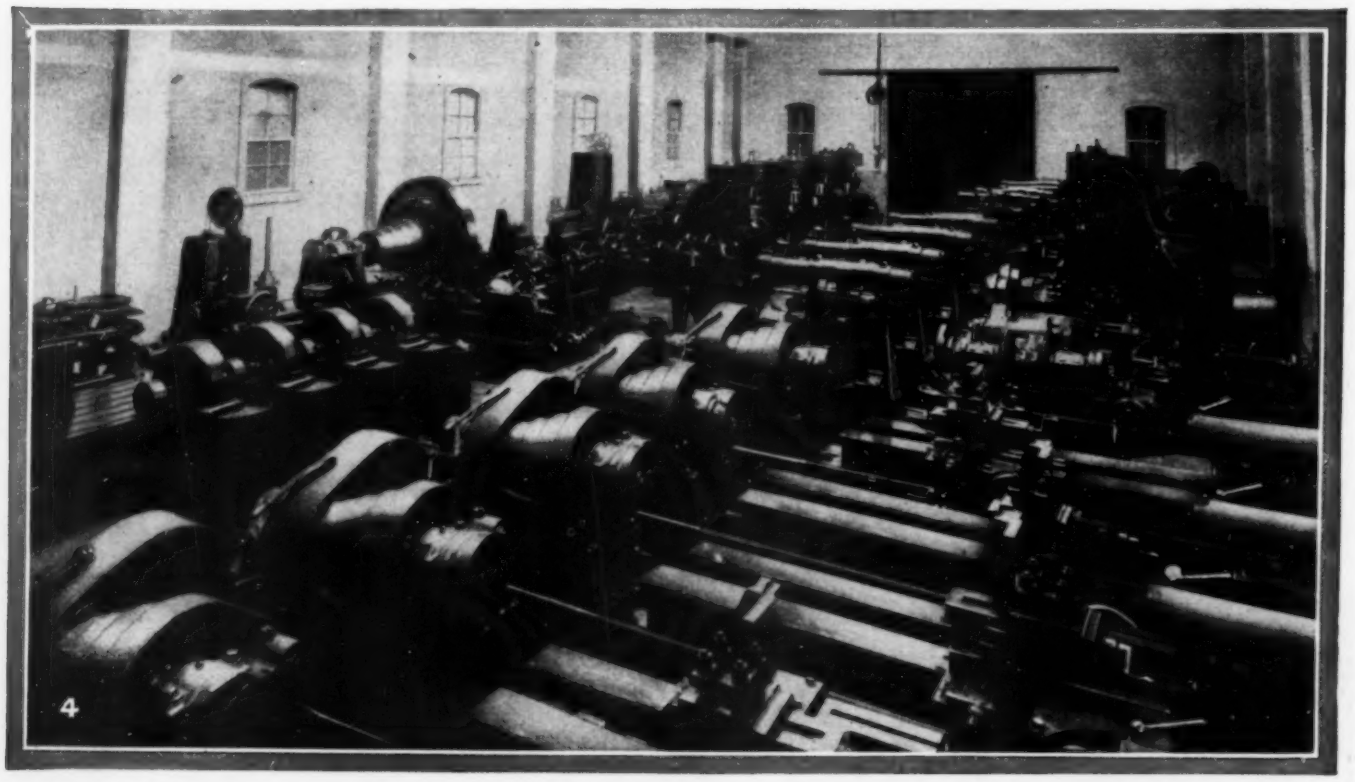


Fig. 5—The planer department. Here is another section of the shop in the high bay, which shows not only the planer equipment but also a good sized planer in process of construction and erection. The illustration also gives a good idea of the type of construction used in the shop building

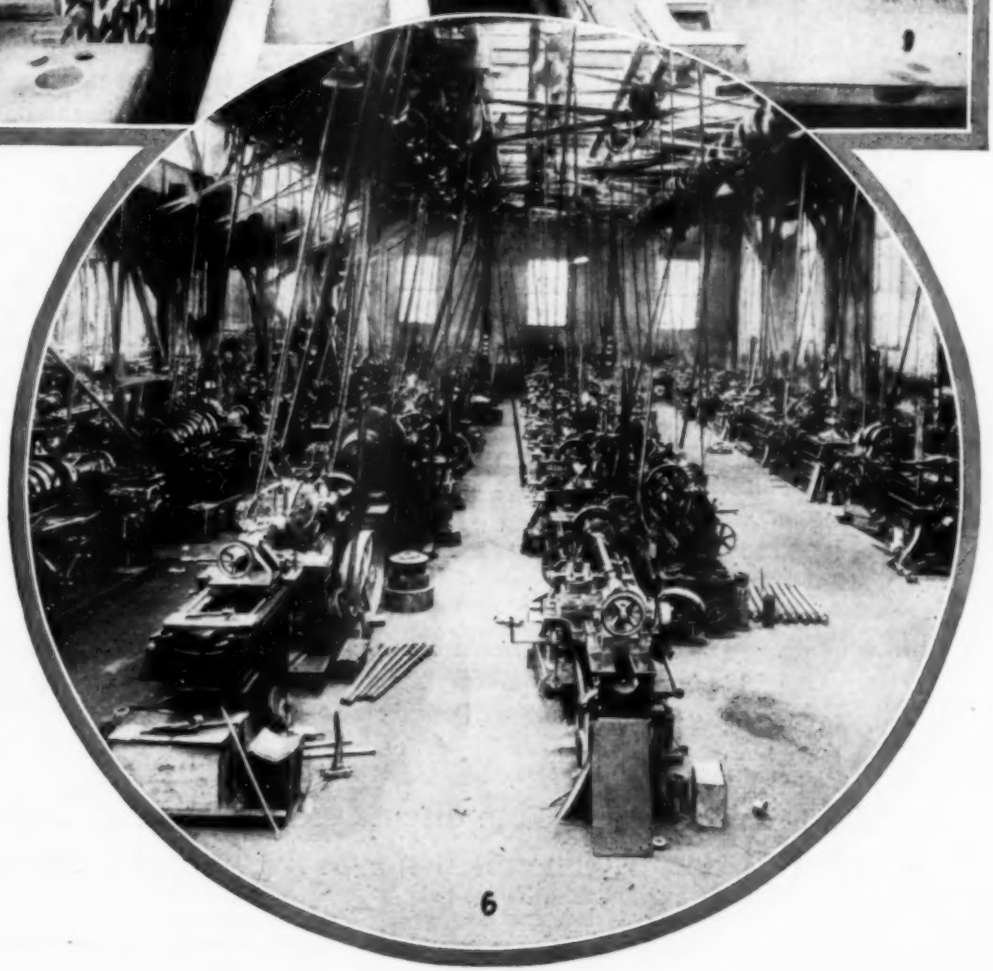


Fig. 6—The lathe department. The illustration gives a good idea of the number of lathes used in this shop and the way in which they are arranged. Everything is belt driven, as in the other departments, and lathes are placed back to back down the center of the bay

THE · FOREMAN'S · ROUND · TABLE

Christmas Parties for the Plant

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"FOR Pete's sake, Al, what's this new racket about having a Christmas party at the works? I got the memo this morning, with the wad of stuff from the committee, but didn't have time to read it all. What are they trying to do, make a communist town out of us? Or do they want to control everything we do? Seems to me Christmas parties are all right for the Sunday Schools, Y.M.C.A., or the Club, but what's the company got to do with it?"

"Well, Ed, I hope you haven't made your decision before you read the material. It's worth while taking it home and reading it over carefully. The memorandum came from the manager's office, but the fact is that the company hasn't a thing to do with it—not yet, at least. It was a sort of a spontaneous affair that started up in the engineering department, and the manager has just distributed the data to sound out the shop.

"Seems that some of the engineers belong to the management association, and they got all enthused about a study that the association made on Christmas customs in manufacturing plants. That's what the printed paper is, a copy of the report.

"You ought to read the points given. There's one big factory in Dayton that had a Christmas party on three evenings, entertaining 8,500 children. Then, a big electric manufacturing company has an old-fashioned Christmas tree celebration every year, Santa Claus and everything, the apprentice boys' orchestra furnishing the musical treat. There are a lot of other examples, all jolly get-togethers for employees and their families.

"Well, to get back to our company. It's like I told you on that insurance affair. Employer and employee have to live together so many hours in the day that they might as well keep on good terms. If the men want a Christmas party to get them better acquainted with each other's families, why, the Big Boss is certainly justified in helping to arrange it. I don't call it butting in at all, Ed. The fact is, I'm one that feels that I'll have a darn good time, and from what I've noticed, Ed, nobody's going to have to force you to dance with some of the pretty daughters."

"Guess there may be something to it, at that, Al. I'll take home the report tonight, and see what it's all about before I put it up to the men."

Are get-togethers worth while for the plant? Is the company justified in encouraging social affairs, or should the family social life be kept distinct from a man's daily job?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Posting Too Many Rules

THE first requisite in handling men is to treat them as men, at least until the individual establishes the need for different treatment. When you emphasize a long list of rules by publishing them on the bulletin board you are treating the men as children, and if they read them at all they are likely to react with the attitude that anything that isn't specifically prohibited or defined must be O.K. Yet, we all realize that it is impossible to anticipate all the "don'ts" that good horse sense would establish automatically for us, so the less we attempt this, the better off we are. Just as passing a lot of petty laws on relatively minor and trivial matters by our legislators does not help to improve civic conditions, so it is with the shop. A rule which is established merely to provide the evidence for conviction when it is violated, defeats its very purpose. It's far better to leave the matter directly in the hands of the foreman, so that he can deal with the offender on the common sense merits or demerits of the case. A heart to heart talk with the violator of good judgment in a language he can understand as applied directly to his case is far more effective than a lot of general rules which he often unconsciously misinterprets if he considers them at all. There is far less opportunity for misunderstanding in direct dealing, and we all know how quickly the "underground telegraph" will spread the news, so that the possibility of repetition of the offense by others is practically eliminated.

—JOHN D. DYER.

RULES and regulations often leave a bad taste in a fellow's mouth, and when there are too many they will only have the effect that none of them will be observed. If rules must be enforced, why not do it painlessly, print them on slips, perhaps one rule or two per slip, and then slip them in the pay envelope?

The example of banks may also be followed by printing rules of the outside of the pay envelope similar to the saving appeals on envelopes often furnished free to shops for their advertising value. My idea would be to let the advertising department weave a little story around each rule such as warning about fire danger from smoking print. Inject human appeal into each rule, suggesting it rather than attempting to enforce it. If properly handled the men will be looking forward to the little stories in their pay envelope, and if the office insists the whole list of rules can be printed on the back of each slip, having the story on the front side.

Of course, if the shop has a company paper, that would be the ideal place to bring out this educational campaign, but the idea of posting the men on various subjects can be done well by putting such matter in the pay envelope, as it is one sure place where nothing is apt to be overlooked.

—J. C. P. BODE.

THE · NEXT · TOPIC

Saving Miller's Job

ADVANCE QUESTION

What is the best way to handle the problem of carelessness? Williams turned a careless man over to Al to straighten out—should he have simply fired him? Al carried the problem into Miller's home.

Making Time Studies

WHEN the time-study man tries to work under cover, he is defeating the very purpose he is trying to attain. That he is antagonizing the mechanic is readily apparent, for he is insulting the mechanic's intelligence. Just as soon as the time-study man tries to put it over on the workman, he is licensing the workman to put it over on him. Under such conditions, the mechanic may "soldier" and make as many false moves as he pleases; but the time-study man has put himself into a position where he cannot object. Instead of two men co-operating in a search for truth, such misguided attempts at time study become an underhanded battle of one man's wits against another's, resulting in mutual distrust where confidence should exist. Time studies should be made by men who are thoroughly conversant with the work under observation by actual experience in performing it, and who can meet the men frankly and above board. The management must pave the way for the time-study man by acquainting the men with the details of the system it is proposed to apply; for, after all, time study is a mutual undertaking. The time-study man must break down his study into all the essential operations and movements, and not attempt to make it on the entire operation. Methods, materials, machines, and tools must first be studied, classified and standardized. This means that for any mechanical operation the machine time, the depth of cut, or the speed and feed are determined and specified, the handling time being the only irregular variable. Time study, with its possibilities for saving time and fatigue will get the full co-operation of the workman if the benefits obtainable are shared with him.

—STANLEY J. GUSTOF.

Getting Ideas from New Men

AL WAS on the long end of the argument regarding getting ideas from new men, and Ed should remember that no organization has a monopoly on new and better methods. The type of men with which the foreman deals must be considered. If the new man is only

a machine operator, and not a machinist, Al probably would not get any original ideas, but might learn the methods in use at the man's former plant.

Regarding Al's idea of giving a man leeway on methods, this depends on the man and the plant. In the toolroom, or in the jobbing shop, the man should have the privilege of his own method, if a correct one. But in the production shop, the method and tools are standardized so that men and machines may be interchanged, and the new man's method could not be used.

—E. THORNTON, *Tool Designer, England.*

THE new man quite probably has ideas of his own. What could better please him than an invitation to pass them on and show the fruits of his own thought? There's no doubt but what the company will be appreciative if the ideas are of value.

The new man has worked in other shops, has seen other methods, has heard discussions by other foremen and supervisors. Possibly he has seen similar problems worked out to better advantage by his former employer. Possibly he has heard his previous "super" discuss a system for increased production with maintained accuracy. In many cases these might be profitably applied to some present situation. Can it be considered wise, then, to place our pride before the company's interests and not seek ideas from the new man? —ROY E. PETERSON.

THE value of getting new ideas by visiting other plants is fairly well established. To seek the advice of new men as to methods of doing work is but a means of visiting other plants without the accompanying inconvenience and loss of time incidental to traveling. In addition to its direct value, it tends to make the new man enthusiastically loyal to an organization that recognizes his ability from the very start. He feels that he has done well to tie up with a company that is willing to ask his opinion on matters even though he is but a new man.

To the foreman, it means new and valuable ideas, as well as a quick appraisal of the value of the new man. If the man hasn't any worth-while ideas, it soon establishes him as a routine man without any great future possibilities, and he can be handled accordingly. In a highly specialized production shop, one worth-while idea will more than pay for the turnover cost of hiring and breaking in a new man. In this way, one of the costs of doing business, namely, labor turnover, can be made to pay for itself, even though it doesn't appear directly on the books. —B. E. LAMBERT.

How Handle the Man Who Can't Listen?

A MAN like Brennan presents a real problem, especially in a shop organization where it is only possible to maintain a comparatively few high-grade mechanics. Naturally a foreman dislikes to cut such a man from his payroll.

At the same time, no matter what his technical ability may be, there are other qualifications that go to make up the truly high-grade man, and one of these unquestionably is an ability to work with others and conform to the ways of an organization and the instructions of one's superiors. Unless a man can listen and absorb what he hears, he cannot hope to measure up to this quality.

Such inattentions may be nothing but a bad habit, and not any indication of deep-seated conceit or bigotry. If this is the case, as is indicated by Ed's statement that he did not think that discourtesy entered Brennan's mind, it would be my impression that patient counsel and regular check-up by some interested person, in whom the subject had confidence, taken in conjunction with a sincere personal effort on Brennan's part, would gradually overcome the trouble. To merely "fire" the man would not cure him or even help him to understand what it was all about, as we are all by nature blind to such pronounced faults in our own characters. —D. C. WRIGHT.

TO COMPROMISE with the man who insists on talking when he should listen is futile. The most vicious phase of this attitude lies in the fact that this man never gives you his mind to work on. Rather, he is holding it aloof trying to formulate what he's going to say, and watching for an opportunity to edge in his thoughts.

So, there is only one way to meet the issue, to insist before you start that he listen until you are finished and then he can talk all he wants to. If necessary, tell him you are going to walk away from him if he interrupts, and mean it. Most of the interruption normally comes because of a very active mind that is always one step ahead of what you are telling him at the moment. If you force him to listen till you are finished, he will have really very little to say, because, in listening instead of talking, he will have practically all the answers to the questions he would have interrupted with otherwise.

—MICHAEL J. KAPLAN.

THE man who will not listen to instructions or corrections, whether from the foreman or the superintendent, is without a doubt a liability. He may be an excellent machinist, a conscientious worker, and valuable in many ways, but that one fault far offsets his value to employer. The delays which are experienced through his lack of attention to instructions may prove very costly, not only in immediate production but more so in future orders and business. —ROY E. PETERSON.

Receiving the New Man in the Shop

I BELIEVE in Al's way of making a new man feel at home in the shop. I do not make it a point to introduce him to each individual, but I introduce him to the men who are nearest to him. I always pick out a simple job for him, giving him the necessary instructions as to our method of doing it, and get the man nearest to him to assist him all he can. I find that this method not only helps the man to feel contented, but it also helps to keep down the scrap pile.

—C. L. HENRY, *Foreman, England.*

SPEAKING from experience, I advise the best policy regarding the new man is to let him alone for a week or two. The less dealings the foreman has with a new man, the better. Drawings are, or should be, self-explanatory, and the new man, if he has any ability, will inquire into dimensions that need special care. Moderately skilled jobs are advised as a beginning, with finer work, perhaps, after the first week. By this time, the man is used to the machine and his surroundings, and after the first fortnight the foreman will be able to have a fairly good idea of the man's ability. —R. G. HEWITT.

Ideas from Practical Men

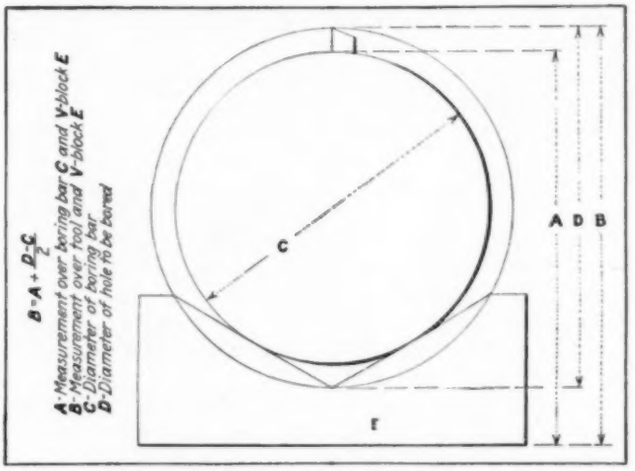
The department, "Ideas from Practical Men," is devoted to the exchange of infomation on methods useful to the machinery industries. Its scope includes all divisions of the metal-woking industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Gage for Setting Boring-Bar Cutters
Discussion

By Charles Kugler

In an article under the title given above, and published on page 283, Vol. 67, of the *American Machinist*, B. R. Sheets, describes one of the many methods of setting the cutters in boring bars to bore holes of specified diameters.

However, there is another method of setting the cutters, as shown in the sketch. This method has the



Setting boring-bar cutters

advantage of not requiring any special tools. All the measurements can be made by placing the boring bar in a V-block and using a micrometer. The sketch shows the method and is self explanatory.

A Home-Made Air Compressor

By L. A. Dolton

Sometimes a home-made device can be built to suit a a particular requirement for less than a manufactured product would cost. Then, too, there is a sense of satisfaction in seeing an idea carried out, as well as a fascination in seeing how good an inventor one may be. On this basis, the air compressor, shown in Fig. 1, was constructed at a nominal cost from miscellaneous parts, the majority of which came from an obsolete "flivver," and the results obtained can be termed satisfactory. As a rule, a purchased product is far better, and more economical in the long run, but since the unit to be described is seldom used, little capital is tied up when it is idle.

An old Ford car, minus a couple of wheels and other trimmings which made it beyond repair, was purchased

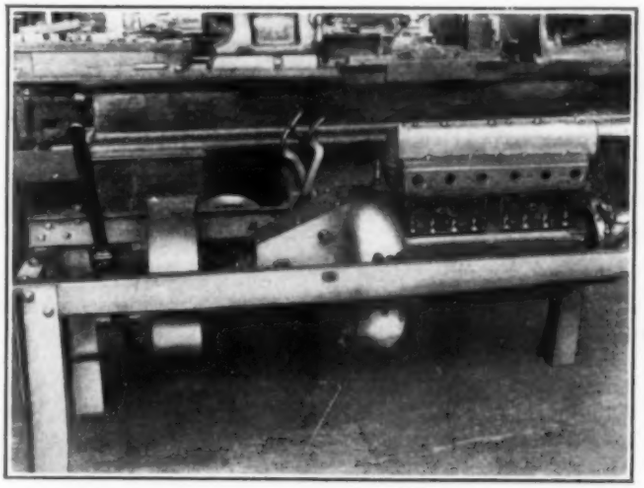


Fig. 1—Air compressor made from an automobile motor

for $15, from which only the motor assembly and frame were needed. As shown, the motor is fastened to the frame which in turn is mounted on angle-iron legs. A special cylinder head, however, was required. The transmission was not removed, although there was no reason for retaining it, inasmuch as the driving pulley could have been connected to the rear end of the crankshaft. A clutch and pulley that happened to be available were attached as shown. If desired, the transmission clutch could be used to engage the drive which is through belt from an overhead lineshaft.

In Fig. 2 is illustrated the head removed and stood on top of the cylinder block, so that its construction and operating features can be determined. A $\frac{1}{8}$-in. gasket is

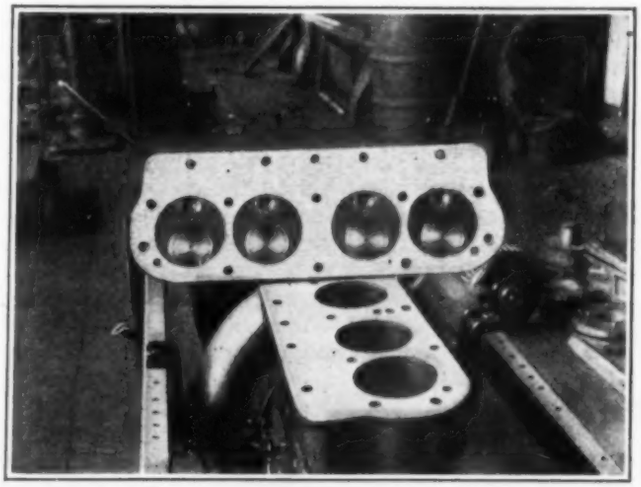


Fig. 2—The special cylinder head removed to show the valve construction

required between the cylinder and the head to offset the distance the piston travels above the top face of the cylinder. The air inlet valves are 2 in. in diameter and the outlet valves are $\frac{1}{4}$ in. in diameter. They operate through suction and compression at each stroke of the piston, so that the compressor operates on the two-cycle principle. When a piston travels downward, the inlet valve of that cylinder opens, since only a light helical spring holds the valve to its seat. Then, as the piston returns, this valve seats and the air compression forces the outlet valve to open, thus allowing the compressed air to pass out through the feed line, located at the front end of the head, into an air tank. At a speed of 300 r.p.m. the compressor delivers 30 cu.ft. of air per min. The unit was built and is used in the shop of the Fulton Machine Co., Chicago.

A Feeler Indicator for Faceplate Work

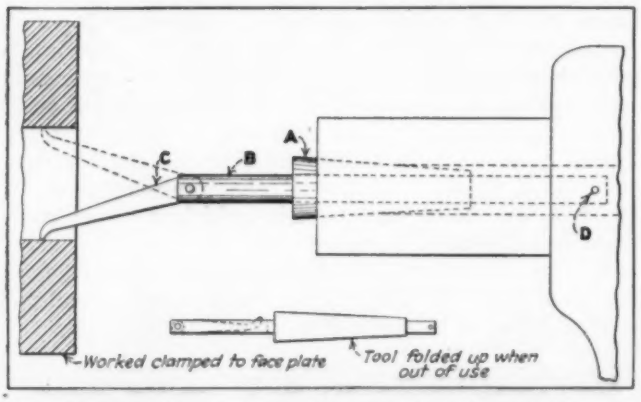
By H. Moore

Hamilton, Ontario

A little tool that often facilitates faceplate work is shown in the illustration. It is for use in setting faceplate work true by a previously bored hole, and by its aid a job can be set so that the hole is true without revolving the lathe.

The tool consists of the body *A*, fitting the tailstock spindle; the sliding rod *B*, fitting the body; the caliper leg *C*, and the retaining pin *D*. All of the parts are made of steel and are carefully fitted. The feeling point of the caliper leg should be hardened.

Rod *B* is slotted far enough down to enable the caliper leg to be folded back into it when the tool is out of use. In operation, the tool is put in the tailstock



Feeler indicator for truing work by a bored hole

spindle as shown, and the caliper leg is set so as to touch one side of the hole. Now slide the rod back so that the caliper leg will clear the work and give it a half turn. Then advance it to bring the caliper leg to the hole to determine the amount of eccentric location of the hole in one direction. Giving the rod first a quarter turn and then a half-turn and following the procedure outlined above, will show the eccentric location of the hole in the other direction. Obviously, when the work has been adjusted so that the caliper leg touches the hole in all four positions, the hole is concentric with the lathe spindle.

It should be emphasized that the tailstock spindle is not moved at all, the rod *C* sliding back and forth in the body of the tool so that the operator can easily feel the setting.

A Progressive Jig-Boring Operation

By Milton Wright

A progressive jig-boring operation is shown in the accompanying illustrations. The part upon which the work is done is an aluminum alloy casting that is to become the operating arm of a Fellows high-speed gear shaper. The work includes drilling and reaming two $\frac{5}{8}$-in. holes near one end of the piece, rough and finish boring a 3-in. hole for the stud upon which the arm

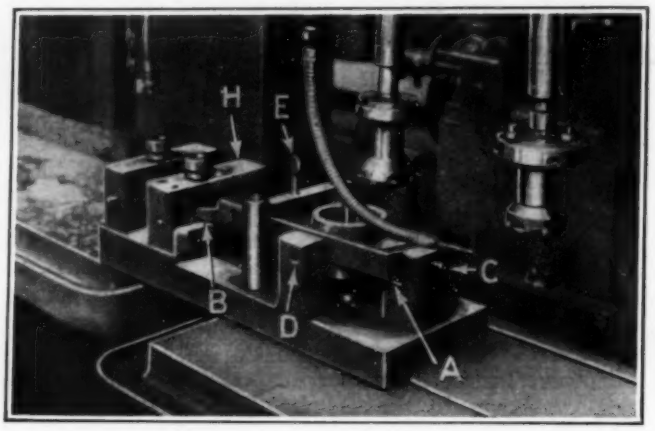


Fig. 1—Boring jig and cutters

fulcrums, and facing both ends of the boss. Two jigs and two drill presses are employed.

The part to be machined is supported in the first jig at *A* and *B*, Fig. 1. It is located by adjustable screws at *C* and *D*, and is secured by the thumbscrew *E* about midway of its length. Slip bushings of the usual form are used in the bridge *H* to guide the drills for the smaller holes. The 3-in. hole is bored by the cutter-heads to be seen in the spindles of the nearer drill press. These cutter heads are guided by a stud that is set permanently in the base of the jig and entering a bushed axial hole in the lower end of each head.

Two cuts are made through the 3-in. hole. The second cut, without further sizing, leaves the hole a force fit for a hardened and ground steel bushing with which the arm is reinforced to provide a wearing surface at the fulcrum.

One of the cutter heads is double, the upper circle of

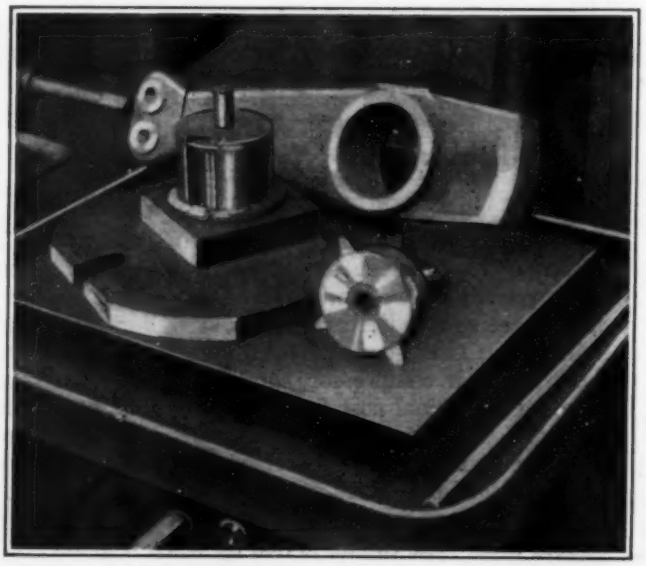


Fig. 2—Jig and cutter used for second facing operation

cutters facing off the top of the boss after the boring cutter has passed through the hole. All of the heads are provided with adjustable inserted bits.

The tables of the two drill presses are adjusted to even height in order that the jig may be moved easily from one to the other. The work may start on either press, so that by starting alternate pieces at opposite ends, one shifting of the jig is avoided.

The work is completed in the first jig except for facing the end of the boss that is now at the bottom. The jig to be seen in Fig. 2, with the cutter head lying on the table of the machine, comprises the full complement of tools for this second operation.

The finish-bored hole in the arm fits snugly over the stud in the base of the jig. A wide groove lengthwise at one side of the stud, having the bottom of the groove slightly eccentric with relation to the periphery of the stud, contains a hardened steel roller of a length equal to the length of the stud, and of a diameter that will allow it to lie at the deepest part of the groove without projecting beyond the peripheral surface of the stud.

The principle of the holding device is that of a roller, or friction, ratchet. The part to be machined is placed over the stud and rotated slightly in the direction that the action of the cutter would tend to drive it, whereupon the roller rolls in its groove until the increasing radius of the bottom of the groove causes the roller to bind against the wall of the bore, when further movement is impossible.

A concentric groove in the stud in conjunction with a similarly disposed groove in the roller provides space for an interrupted ring of spring wire, which, when snapped into the groove, prevents the roller from falling out of place each time the work-piece is removed. To remove the work-piece it is necessary only to rap it slightly in a direction opposite to the rotation of the cutter, when the grip of the roller will be released at once.

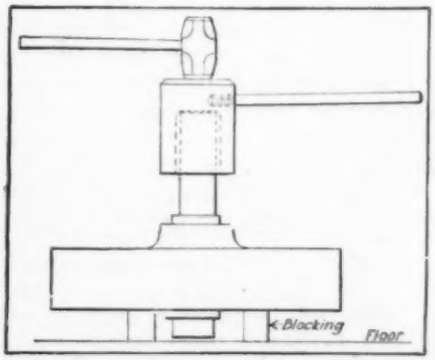
The facing cutter is guided by a stud of smaller diameter entering a bushed axial hole in the cutter head.

A Safety Striking Piece

By H. L. Wheeler

In jobbing shops that handle heavy work, manual methods of making drive fits are commonly used. The usual method is to drive a shaft in or out with a heavy sledge hammer. To prevent the shaft from being upset on the end, it is customary to have one man hold a striking piece on the end of the shaft while another man swings the sledge.

Some men are more expert with a sledge than others and the one holding the striking piece often does so with a great deal of timidity and fear that the hammer man may swing wide and injure him. In any case it is not a pleasant sensation to have a 20-lb. sledge swung close to your head. The striking piece shown in the illustration will stay in place until the shaft is driven home and may, in many cases, be used without the aid of a helper. It is preferably made of nickel steel and heat-treated, so as to be as tough as possible. It may be provided with a rod handle for convenience in holding, when this is necessary, and long enough to allow the one who holds it to stand a safe distance from the swinging sledge. Its weight is sufficient to make good contact with the end of the shaft.

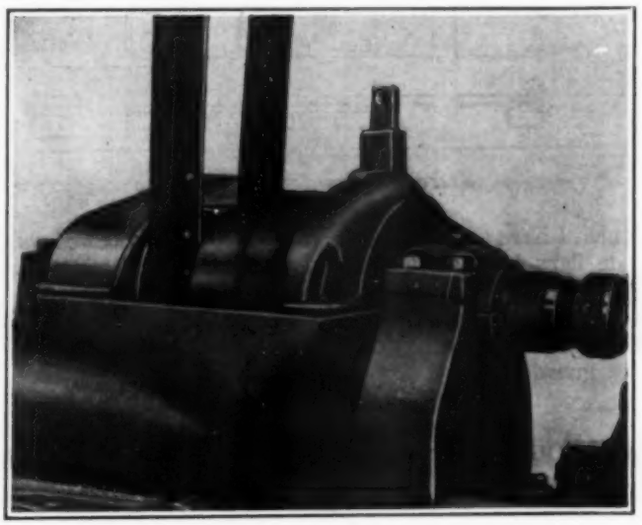


A safety striking piece

Spindle Lock for a Lathe

By Edwin Kilburn

When removing the chuck or faceplate from a lathe, or when bolting work to the faceplate, it is very desirable that some means be provided to prevent the spindle from turning. It is true that the spindle can be locked by putting the back gears in mesh while cone pulley is locked to the large gear on the spindle. However, this method is rather inconvenient at times and a direct-acting lock is to be preferred.



A direct spindle lock

A lock we recently made is shown in the illustration, mounted on a lathe. It consists of a suitable guide and a plunger, the guide being attached to the gear guard. The lower end of the plunger is shaped to fit the tooth spaces in the large gear on the spindle. To lock the gear, and likewise the spindle, the plunger is pushed down into engagement with the gear. A small depression countersunk in the plunger acts as a finger hold when pulling it out of engagement. A ball in the side of the plunger, backed by a spring, holds the plunger up when it is in the out position.

Protection for Planer Ways—*Discussion*

By Elton Sterrett

Reading the article by H. L. Wheeler, under the title given above, and published on page 442, Vol. 67, of the *American Machinist*, took me back to my apprentice days in a railroad shop.

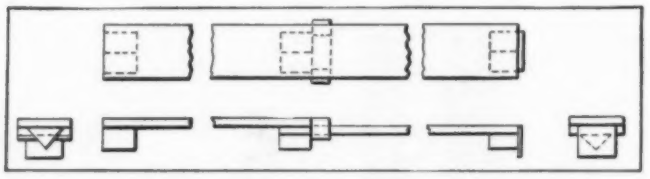
"Old Dutchy"—if he had another name we never knew it—had charge of the big planer, and he had devised the telescoping guard shown in the sketch to keep the ways

clean. Unlike Mr. Wheeler's guard, Dutchy's, when closed, was but little more than half as long as the exposed parts of the ways, and could be used whether the bed was run back to the end or not. The shorter length was also much more easily handled and stored. In fact Dutchy would hook the iron plate, shown as the square in the right end elevation, over the end of the ways, slide the guard out as far as the table would let it come, and then use the flat wooden top as a convenient tool and caliper rest.

Dutchy even tacked felt pads to the sloping sides of the V-blocks and oiled them occasionally so that they would not rust the ways when left in one spot for a considerable period of time.

The only additional parts in Dutchy's guards, over those described by Mr. Wheeler, were the end stops and the L-shaped guides.

Since graduation from my apprenticeship I have installed a number of "Old Dutchy" guards in shops with



A telescoping guard for planer ways

which I have been connected, and in two instances canvas side flaps have since been added to more effectively to guard the ways from dust and grit. When this refinement is added, the L-shaped guides on the side give way to a guide in the center of the lower or outer half of the guard.

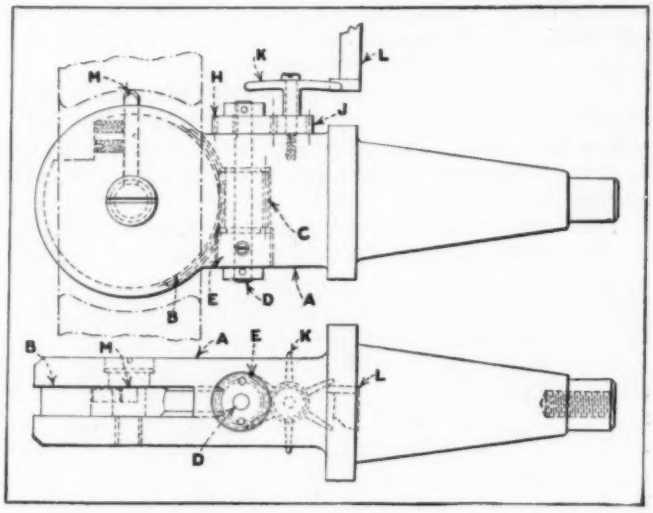
A Tool for Boring Spherical Bearings

By B. J. Stern

The boring tool illustrated in the sketch is for finishing spherical split-bearing seats in the headstock castings of a lot of special disk grinding machines.

The boring job is done in a milling machine, on the table of which the castings to be machined are so clamped as to bring the central line of the bearings in line with the center of the machine spindle. The flatted head *A* of the tool, shaped to suit the casting, is located in the center of the bearing, as is evident from the sketch. A slot in the tool head contains the closely-fitted worm sector *B* that rotates on a shoulder stud in the head so located as to correspond with the center of the bearing. The worm *C* actuates the worm sector. The bearing for the worm, in which is fitted the worm shaft *D*, is bored in the head, and in order to assemble the worm it is necessary to bore one side of the bearing large enough to admit the worm. The bore in this side is then threaded and the bushing *E* is screwed in, being locked in place by a set-screw. The worm is turned by the spur gear *H* located outside of the head *A*, being in turn rotated by the small gear *J* that is integral with the six-pointed star wheel *K*. As the tool revolves, the star wheel strikes the projection *L* fastened to the table of the milling machine, thus being rotated one-sixth of a turn at each revolution of the tool. In a slot in the worm sector, so cut as to bring it radial to the bearing to be bored, is the toolbit *M*.

It will readily be seen that as the tool revolves, motion is communicated to the worm sector through the star



Spherical boring tool

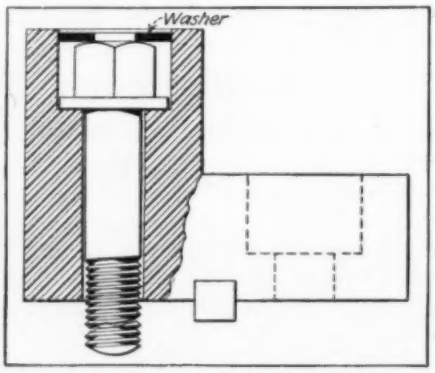
wheel, gears and worm, causing the toolbit attached to the sector to travel in a circular path in a direction at a right angle to the motion imparted by the spindle of the machine. Thus the castings are bored spherically.

The design of the tool can be modified so as to make it useful for other work.

Keeping Out the Chips

By Harry E. Stevens

In running a boring mill on chucked work, trouble was experienced from chips getting into the clearance holes for the heads of the bolts that hold the chuck jaws to the slides on the table. When the positions of the jaws had to be changed to accommodate different jobs, the socket wrench could not be entered in the holes to loosen the bolts without digging out the chips. In looking around for some means to keep the chips from clogging the holes, I discovered that ordinary washers of a size to fit freely in the holes, would lie on the boltheads slightly below the surface of the jaws, and would fit the holes closely enough to keep any but the finest chips from entering. The sketch shows the idea. The washers do not interfere in any way with placing or holding work in the jaws. They can be removed by pressing the finger on one side, tilting them on the bolt heads so that they can easily be picked out.



Washers used as chip protectors

From the inspector's point of view anything not within prescribed tolerance is wrong. Permission to vary from tolerances is a function of the salvage department.

Standard Bolt Heads and Nuts

(Continued from sheet 14)

The width across flats of rough and semi-finished regular nuts, finished square and hexagonal nuts, and jam nuts, will be $1\frac{1}{2}$ D except for the diameters from $\frac{1}{4}$ to $\frac{9}{16}$ in., which will be $1\frac{1}{2}$ D + $\frac{1}{16}$ in. The 16th-in. sizes are used to eliminate 32d-in. wrench openings.

Tolerance for width across flats of rough and semi-finished regular nuts is 0.05 D. The thickness of rough and semi-finished regular nuts is $\frac{7}{8}$ D, and the tolerance for the thickness is 0.032 D + 0.024 from the minimum. Semi-finished nuts are faced on the bearing surface, and at right angles to the axis of the thread within 3 deg. Maximum side taper 4 degrees.

The tolerance for width across flats of finished square and hexagonal regular nuts is 0.015 D + 0.006. The thickness of finished regular nuts is $\frac{7}{8}$ D. All of the finished regular nuts are washer faced, with the thickness of the washer face $\frac{1}{64}$ in. The thickness of the nut is the distance from top to the bearing surface.

The tolerance for width across flats of finished and semi-finished jam nuts is 0.015 D + 0.006. The thickness of jam nuts for sizes from $\frac{1}{4}$ to $\frac{7}{16}$ in. is $\frac{1}{2}$ D + $\frac{1}{32}$ in.; for sizes from $\frac{1}{2}$ to $1\frac{1}{8}$ in. it is $\frac{1}{2}$ D + $\frac{1}{16}$ in.; for sizes from $1\frac{1}{4}$ to $2\frac{1}{4}$ it is $\frac{1}{2}$ D + $\frac{1}{8}$ in.; and for sizes from $2\frac{1}{2}$ to 3 in. it is $\frac{1}{2}$ D + $\frac{1}{4}$ in. The tolerance for thickness is 0.030 D + 0.005 from the minimum.

The thickness of light nuts is $\frac{7}{8}$ D (to the nearest 64th lower for $\frac{1}{4}$ to $\frac{7}{16}$ in. sizes). The tolerance for the width across flats is 0.015 D + 0.006. The tolerance for thickness is 0.030 D + 0.005 from the minimum. The finished tops of the nuts, when not castellated, are flat and chamfered, the angle of chamfer being 30 deg. with the top surface. The nuts are washer faced.

(Continued on sheet 14b)

Table V—Rough and Semi-Finished Square and Hexagonal Regular Nuts

Diameter of Bolt D	Width Across Flats Maximum	Width Across Flats Minimum	Minimum Width Across Corners Hex.	Minimum Width Across Corners Square	Thickness Nominal	Thickness Maximum	Thickness Minimum
¼	0.4375	0.425	0.485	0.584	7/32	0.235	0.203
5/16	0.5625	0.547	0.624	0.751	17/64	0.283	0.249
⅜	0.6250	0.606	0.691	0.832	21/64	0.346	0.310
7/16	0.7500	0.728	0.830	1.000	⅜	0.394	0.356
½	0.8125	0.788	0.898	1.082	7/16	0.458	0.418
9/16	0.8750	0.847	0.966	1.163	31/64	0.505	0.463
⅝	0.9375	0.906	1.033	1.244	35/64	0.569	0.525
¾	1.1250	1.088	1.240	1.494	21/32	0.680	0.632
⅞	1.3125	1.269	1.447	1.742	49/64	0.792	0.740
1	1.5000	1.450	1.653	1.991	⅞	0.903	0.847
1⅛	1.6875	1.631	1.859	2.239	1	1.030	0.970
1¼	1.8750	1.813	2.067	2.489	1 3/32	1.126	1.062
1½	2.2500	2.175	2.480	2.986	1 5/16	1.349	1.277
1¾	2.6250	2.538	2.893	3.485	1 17/32	1.571	1.491
2	3.0000	2.900	3.306	3.982	1¾	1.794	1.706
2¼	3.3750	3.263	3.720	4.480	1 31/32	2.017	1.921
2½	3.7500	3.625	4.133	4.977	2 5/16	2.240	2.136
2¾	4.1250	3.988	4.546	5.476	2 13/32	2.350	2.462
3	4.5000	4.350	4.959	5.973	2⅝	2.685	2.565

Table VI—Finished Square and Hexagonal Regular Nuts

Diameter of Bolt D	Width Across Flats Maximum	Width Across Flats Minimum	Minimum Width Across Corners Hex.	Minimum Width Across Corners Square	Thickness Nominal	Thickness Maximum	Thickness Minimum
¼	0.4375	0.428	0.488	0.588	7/32	0.225	0.212
5/16	0.5625	0.552	0.629	0.758	17/64	0.273	0.258
⅜	0.6250	0.613	0.699	0.842	21/64	0.336	0.320
7/16	0.7500	0.737	0.840	1.012	⅜	0.384	0.366
½	0.8125	0.799	0.911	1.097	7/16	0.448	0.428
9/16	0.8750	0.861	0.981	1.182	31/64	0.495	0.473
⅝	0.9375	0.922	1.051	1.266	35/64	0.559	0.535
¾	1.1250	1.108	1.263	1.521	21/32	0.670	0.642
⅞	1.3125	1.293	1.474	1.775	49/64	0.781	0.750
1	1.5000	1.479	1.686	2.031	⅞	0.893	0.858
1⅛	1.6875	1.665	1.898	2.286	1	1.019	0.981
1¼	1.8750	1.850	2.109	2.540	1 3/32	1.115	1.072
1½	2.2500	2.222	2.533	3.051	1 5/16	1.338	1.288
1¾	2.6250	2.593	2.956	3.560	1 17/32	1.560	1.503
2	3.0000	2.964	3.379	4.070	1¾	1.783	1.718
2¼	3.3750	3.335	3.802	4.579	1 31/32	2.005	1.932
2½	3.7500	3.707	4.226	5.090	2 5/16	2.228	2.148
2¾	4.1250	4.078	4.649	5.599	2 13/32	2.450	2.363
3	4.5000	4.449	5.072	6.108	2⅝	2.673	2.578

Table VII—Finished and Semi-Finished Jam Nuts

Diameter of Bolt D	Width Across Flats Maximum	Width Across Flats Minimum	Width Across Corners of Hexagon Minimum	Thickness Nominal	Thickness Maximum	Thickness Minimum
¼	0.4375	0.428	0.488	5/32	0.163	0.150
5/16	0.5625	0.552	0.629	13/64	0.195	0.180
⅜	0.6250	0.613	0.699	7/32	0.227	0.211
7/16	0.7500	0.737	0.840	¼	0.259	0.241
½	0.8125	0.799	0.911	9/32	0.323	0.303
9/16	0.8750	0.861	0.980	11/32	0.355	0.333
⅝	0.9375	0.922	1.051	3/8	0.387	0.363
¾	1.1250	1.108	1.263	7/16	0.451	0.424
⅞	1.3125	1.293	1.474	½	0.516	0.484
1	1.5000	1.479	1.686	9/16	0.580	0.545
1⅛	1.6875	1.665	1.898	5/8	0.644	0.606
1¼	1.8750	1.850	2.109	11/16	0.771	0.729
1½	2.2500	2.222	2.533	¾	0.900	0.850
1¾	2.6250	2.593	2.956	1	1.029	0.971
2	3.0000	2.964	3.379	1⅛	1.158	1.093
2¼	3.3750	3.335	3.802	1¼	1.286	1.214
2½	3.7500	3.707	4.226	1⅜	1.540	1.460
2¾	4.1250	4.078	4.649	1½	1.669	1.581
3	4.5000	4.449	5.072	1¾	1.798	1.703

Table VIII—Hexagonal Light Nuts

Diameter of Bolt D	Width Across Flats Maximum	Width Across Flats Minimum	Minimum Width Across Corners	Thickness Nominal	Thickness Maximum	Thickness Minimum
¼	0.4375	0.428	0.488	7/32	0.225	0.212
5/16	0.5000	0.489	0.557	11/64	0.273	0.259
⅜	0.5625	0.551	0.628	13/64	0.336	0.320
7/16	0.6250	0.612	0.698	⅜	0.384	0.366
½	0.7500	0.737	0.840	7/16	0.448	0.428

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Technical Abstracts

Grinding Machine Lubrication Problems

Accuracy and rigidity are paramount requirements in grinding machines built for mass production service. These features are characteristic of the machine when put into service, but their maintenance is a problem for the operating engineer and the lubrication specialist.

The main spindle is regarded as the most important member from the viewpoint of lubrication by virtue of its size, the heavy duty to which it is subjected, and the high speeds which frequently prevail. Where this spindle is provided with plain sleeve bearings the sight-feed oil-cup affords the requisite degree of lubrication, especially when there is an oil distributor properly located within the bearing housing.

Flood lubrication by means of a suitable chain-driven pump has been developed to a marked degree. There must be adequate reservoir capacity with such a system to carry the requisite volume of oil and provide for settling. Flood lubrication insures the greatest degree of cleanliness, for in addition to serving as a lubricant the oil will usually wash the entire system free from accumulated foreign matter. An advantage of this system is that a minimum of attention is required, and normally but little adjustment.—A. F. Brewer, *Abrasive Industry*, November.

The Largest British Automobile Builder

It is interesting to note that the same foresight which was responsible for the rapid growth of the Ford Motor Co. in the United States has also made possible the unprecedented growth of the Morris Company in England. This was the realization that a small, light car that could be sold at a low price would meet a wide demand. From 357 cars in 1920, the Morris Company grew to 56,000 cars in 1926, and is expecting to reach the 60,000 mark for 1927. It is also interesting to note that their 56,000 cars in 1926 was over one-third of the total of 158,000 cars produced by 62 manufacturers in Great Britain.

The Morris Company has several factories in the south-central portion of England, at distances varying from 50 to 100 miles from London. There are car assembly plants at Oxford and Cowley. The engine plant is at Coventry, while the one-ton truck is built in Birmingham. Another factory is at Le Mans, France, but this has a comparatively small output.

Large numbers of specialized American machines for high production work are in operation, particularly in the plant in Coventry. British built machines and tools also show the influence of American practice. The Coventry plant is one of the few in England that have worked for a considerable period for 24 hours and 7 days per week.

Every effort is made to keep the inventory of work in process at a low point. In the engine plant, for example, there are never more than 2,500 cylinder blocks in the factory for an output of 1,250 engines per week. The total number of employees is about 10,000, the rate of pay being quoted at considerably above the average for the motor industry as a whole. Employees also are given the benefit of company insurance. —William M. Park, *Commerce Reports*, Nov. 7.

The Army System of Maintenance of Motor Transportation

This tells how and why the Army maintains its own equipment, operated in all parts of the world, with soldier labor, and how it has done so at a cost much lower than have any other operators of motor transportation.

The Army, with its operating centers widely dispersed and its maintenance or repair centers closely combined, is admirably situated to recommend to commercial operators of motor transportation its system of maintenance. The influence that the laws of management have had in the advancement of the maintenance of motor transportation from the vocational to the professional plane may be exemplified by citing a few instances of the direct adaptation of the laws or fundamental principles of management to the Quartermaster Corps Motor Transport Reconstruction Park, Camp Holabird, Baltimore.

The author discusses the great shortage of skilled mechanics who are required for the maintenance of the ever increasing number of motor-vehicles, and the difficulty of getting satisfactory service. He also explains how the Army is solving the problem of securing a sufficient number of men to do satisfactory work in maintaining the motor-transportation equipment operated by the Army. In accordance with the laws of management, the three accepted ways of getting satisfactory work done by unskilled labor are, division of labor, leadership, and incentive reward. Other accepted ways are, authority with responsibility, transfer of skill, and task work. The Army shops at Camp Holabird apply these laws and fundamental principles by dividing the shops into departments and subdividing the departments. The labor of maintaining and reconditioning motor-transportation equipment is divided so that to each worker is assigned either one or a very few manual or mental operations. This one factor in management tends greatly to improve the quality and to increase the quantity of the output of unskilled labor. The term "skilled labor" or "expert mechanic" is minutely defined by the author.

Another important factor that the shops at Camp Holabird demonstrate in a very clear way is the assigning of a definite task to each department or group of workers by the use of production boards which show the quantity required to be produced in a given period. These departmental production boards not only set a definite task but create incentive in the workers by giving them credit for the work done. When the men are given credit for the work done, through the posting by its foreman of the number of units completed by each group of workers, they have an incentive to work fast and take an interest in the organization.

Means of increasing production are described and illustrated with charts. The statement is made that during the last year considerable study has been devoted to the subject of the unit-replacement system for making repairs to motor-transport vehicles. — Lieut. Walter C. Thee, U. S. A., *The Journal of the Society of Automotive Engineers*, November.

Electric Heat-Treatment

Production managers in automobile plants are finding the solution of many heat-treating problems in the adoption of electric furnaces for these most important steps in manufacture.

At the Gemmer Manufacturing Company, Detroit, where steering gear equipment used on many well-known pleasure cars is made, heat-treating operations are carried on with electric furnaces located directly in the production line in the machine shop. The electric heating equipment consists of one pusher-type, counter-flow carburizing furnace and two automatic rotary furnaces. Also in use are six 30-kw. cyanide pots and a 60-kw. japanning oven. All of this apparatus is installed in the machine shop, adjacent to machine tool and assembly operations. Although all the furnaces are described in the original article, only the first will be treated here.

The furnace that is used to carbonize steering gear parts measures approximately 44 ft. long by 19 ft. wide by 7 ft. from floor to top of steel work. A wall extends the full length of the furnace, dividing it into two equal sections, each consisting of two heating chambers in the center and one cooling and preheating chamber at each end. Alloy rollers are provided upon which inverted carburizing boxes travel. The

walls and arches of the furnace are built up with fireclay brick, insulated with 12½ in. of heat-insulating brick. The entire structure is incased in steel plates on the two sides and bottom and cast-iron members at each end of the furnace.

The heating equipment consists of a total of 360 kw. designed for operation on a 220-volt, three-phase, 60-cycle circuit. This load is divided into eight control circuits, two control circuits per heating chamber. The heating elements are mounted on the side wall and on the hearth of each heating chamber. Splitting the control circuit in each heating chamber into two circuits permits the operation of the entrance end of the furnace at a temperature entirely independent of the ultimate soaking temperature desired at the exit end of each chamber. This relation may be maintained automatically by correlating the rate of travel of the boxes and the heating-up, or entrance-end temperature.

Each row of boxes going through the furnace can be treated, as far as temperature is concerned, without any reference to the adjoining row or rows when varying temperatures are required for carburizing parts requiring different case depths. Likewise, the individual chambers and the wall separating the furnace into two equal sections permit operation of the furnace at 50 per cent capacity, and, if no regeneration is desired, one chamber may be run by itself.

The heating elements consist of 80/20 nickel-chrome rolled ribbon resistors suspended away from the walls of the furnace by special insulators. These insulators have only knife edge contact with the heating element. It has been found that for a given furnace temperature this type of insulator permits a decrease in actual ribbon temperature of more than 100 deg. Fahrenheit.

Each of the two heating circuits in each heating chamber is connected to a standard General Electric automatic control panel. Each thermocouple is connected to a Leeds & Northrup recording regulator of the potentiometer type, which in turn actuates the operating relay.

The carbonizing boxes are loaded and packed at one side of the furnace. The gross weight of an average box, including box, compound, parts and cover, is 401½ lb., and the furnace accommodates 30 boxes per row. The gross production per hour for the furnace is 2,680 lb., and the net production per hour is 1,752 lb. The operating or soaking temperature is 1,650 deg. F. The temperature maintained at the incoming end of each heating chamber is 1,700 deg. F. The boxes are in the preheating chamber five hours, in the heating and soaking chamber eight hours, and in the cooling chamber five hours, the total cycle being eighteen hours for a 0.040-in. "case."

The furnace, when turning out this production, operates on a 36-minute cycle, which means that in eighteen hours it will turn out a total of 120 boxes, or in 24 hours a total of 160 boxes. There is one pusher for each row, two pushers being located at one end of the furnace and two at the opposite end. The mechanism is interlocked so that each of the operations takes place in its proper sequence. When a pusher in a given row starts in motion, the furnace doors at each end of the row rise automatically and remain in this position until one box has been charged and another box discharged: then both doors close. When a box reaches a position just inside of the discharge door, the box overbalances itself and rolls by gravity out of the furnace to a position where it is clear of the furnace door.

This carburizing operation was previously carried on in box type, batch-type furnaces heated with fuel, but it was impossible to get satisfactory results continuously without depending upon skilled labor. The results varied widely, because of the fact that the boxes were placed over a considerable furnace hearth area. In the new equipment the results, once established, are repeated continuously and automatically with a minimum of labor.

The entire equipment is situated in the immediate vicinity of the machines on which previous and succeeding operations are carried on. This naturally eliminates a great deal of trucking, waste floor space, and time lost between the heat-treating department and the machining department. In this particular plant the furnaces are located in the middle of the machining and grinding equipment.—*Electrical World*, November 5.

Solving Industrial Problems Abroad

A survey of European industrial plants shows that those destined for managerial positions are starting at the bottom and learning the business from the ground up. Even the psychotechnicians, many of whom might be described as psychologists with an engineering method of attack, have generally started at the bench and mastered at least one trade.

American management methods are being studied more critically and are not adopted until they have been modified to fit local conditions. There is also increasing appreciation of the fact that it is necessary to find out not only what one can do—with whom and with what, and to what amount, and where and when and how—but, who wants it when it is done and can pay for it promptly. The engineering method of attack is gaining strength everywhere.

Motion study, skill study, and fatigue study are proceeding to varying degrees in Germany, Italy, Czechoslovakia, Russia, Switzerland, England and France. There is also active interest in selection and training of operators. Psychological tests are being made in many plants. Standard practice is not as well developed as in the United States but standards affecting materials, tools and machines are quite as far advanced. Lillian M. Gilbreth in *The Management Review*, November.

Prices in the Catalog

In a recent survey, the McQuay-Norris Mfg. Co., maker of pistons and piston rings, ascertained that often the inclusion of prices in the catalog is a direct and positive detriment to selling. Out of a large number of dealers who were approached, 40 per cent declared they found the greatest difficulty, when ordering from a catalog, in knowing just what the manufacturer wanted to charge. Any prospective purchaser of a piece of merchandise, be he retailer or consumer, is interested in price almost first of all. In any event, he is going to know the price before he buys.

The natural ambition of every organization is to have a catalog that will produce actual, traceable sales—a catalog whose message is so complete that the prospect will send in his order, pay the money, get the goods, and keep them.

The net-price catalog is obviously the best of all. Its prices, quoted in plain type in connection with each item, should be guaranteed for the life of the book. This may be for a month, or it may be for a season, on the Sears-Roebuck or Montgomery-Ward plan. But it is plainly impossible, at the present stage anyway, for the greater number of catalog sellers to use the net-price method. In the cases of hardware and machinery, merchandise of this type has no seasonal appeal, and is staple all the year. To quote net prices would be impractical, if not impossible. They have to get along with list prices and discount sheets.

The hardware wholesalers and others have done a great deal in recent years to simplify the discount system, and when a manufacturer has a limited line, and still wants to employ the discount system, he can get suggestions by a study of the catalogs of some other firms. On the other hand, many manufacturers put out catalogs which merely describe the various machines so far as can be done in print. The International Harvester Co. puts out an elaborate cloth-bound book called a catalog, in which not a price is mentioned. It is a treatise on farm machinery, and every item the company makes is described in full detail, and methods of using are set forth. Many pages are devoted to the company and its facilities to help the dealer. The book is frankly educational, with the object of teaching dealers what International goods are and what they can do. A dealer who studies the book can have a fair knowledge of farm machinery, and he can use it also to show to his customers and sell items that he may not have in stock. With the price consideration out of the way entirely, a manufacturer may be safe in putting out an elaborate catalog as seldom as every other year, depending upon the nature of the business, and whether the product is stabilized or constantly changing in variety and style.—G. A. Nichols, *Printers' Ink Monthly*, Nov., 1927.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

A Fault in Machines

A LETTER just received from the vice-president of a small but exceedingly well equipped engine building plant complains about the difficulty of moving machine tools. His plant has been suffering the pangs of two rapid expansions to meet suddenly increased orders and the necessary rearrangement of production equipment at short intervals has brought home to him very clearly the apparent belief on the part of the designer that his machine was to be as permanent as the pyramids in its location.

The time has gone by when machines could be set up and left undisturbed for years. Rapid changes in product and fluctuations in orders now require manufacturers to relocate some of their machines with relative frequency. The popularity of individual motor drive is evidence of the trend. Yet some designers are making no provision whatever for handling. Some machines even have ribs so placed that the machine cannot be moved on rollers.

Isn't is about time for this type of designer to awaken to present conditions in the shop and design his machine so that it can be relocated without difficulty?

Installments or Rebates?

STRIPPED of all its trimmings of loose thinking and acrimonious talk, price cutting stands forth as an attempt on the part of its perpetrators to widen their markets. That it is a distinctly unsound method of achieving that end has been amply proved by experience.

In one form it differs little from the rebate system that had so much to do with getting the railroads into their present regulation troubles. In another it has had a thorough trial in the automobile industry through the "trade-in" and has proved its deadliness by the trial of dealer failures it has left behind. Both forms are in daily and disastrous use in the equipment industry.

Why should the equipment builders try to widen their markets by means of price cutting and make almost no use of installment selling for the same purpose? Probably because tradition is still a potent force in the industry. Price cutting has always been resorted to in emergency and the present generation continues it because the last one knew no better. The present generation is more to be blamed because it does know better.

Installment selling, on the contrary, was not understood by the fathers of the present managers and was therefore looked upon as in the same evil category with modernistic religion and the evolution theory. The fact that it had long been practised in the selling of real estate and life insurance apparently was not considered.

There was some excuse for the last generation but there is none for this one when it sticks to price cutting and ignores sound installment selling as a market widener. The whole system has been carefully studied and the credit risks analyzed mathematically. The automobile industry owes its present prosperity to it, and so does the radio industry. Why, then, should not the equipment makers profit from the experience of these industries, avoid the mistakes that have been made by granting too liberal terms, throw the futile price cutting policy overboard, and save themselves by adopting sane installment selling?

Reliable Sources of Supply

RELIABLE sources of supply are of greater value to all of us than we perhaps realize. This is particularly true of manufacturers who, with few exceptions, buy both raw materials and accessories from outside sources. The cost of a few delays and of defective material must all be counted when considering a change of supply.

It is frequently a great temptation to break away from old connections. Lower prices, more courteous treatment, and more prompt deliveries are all lures for the changing of accounts from the old to a new vendor. And it is frequently the only safe method to follow, or else a newcomer in the field would never get an order. But changes should be made very carefully unless we court the disappointment that comes from the discovery that large promises made by a seeker for new business are not always fulfilled.

Some buyers shift frequently and are reputed to get the minimum prices. Others continue to buy from one source for a quarter of a century. A small saving in the list price of an article may be a costly economy—or it may be the part of wisdom. Facts can be found to prove either contention.

Careful attention to details, to courtesy and to fair dealing will help wonderfully on both sides.

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Cincinnati Rail Guide Planer

A RAIL guide planer, with some improved features, was recently placed on the market by the Cincinnati Planer Company, Cincinnati, Ohio. This machine is designed to plane eight rails, 16 ft. long, at a single setting. The guides are planed on the sides and top and seven cutting tools are required for each rail, making a total of 56 tools at work.

The bed is made twice as long as the table and the Vs of the bed have forced lubrication through a pump which also supplies oil to the bearings and gears. The gear section of the bed has been made deeper than usual to give additional strength. The table is of box-type construction and has an inner guide between the Vs as well as a table clamp on both sides, on the outside of the Vs, for the full length of the table. Integral with the table are pockets in which the cutting lubricant is collected and returned to the supply tank by means of a trough placed on the left-hand side of the machine.

The gearing throughout the machine is made of steel. The pinions are made of alloy steel, heat-treated, and the gears are made of high-carbon steel rings shrunk on steel centers. All of the gearing is sprayed with oil.

The housings have been cut down to accommodate the necessary height and are bolted securely to the bed and also fitted to a tongue which is integral with the bed. On the top they are tied together with the standard box arch developed by this company.

The rail is deep and is provided with power movement so that it can be adjusted for the different heights of guide rails. The one-piece tool slide is as wide as the machine and slides on a narrow guide. Two screws are used for raising and lowering this slide either at rapid traverse or at the feed rate. A reversible motor, placed on the top of the machine, is used to furnish the rapid traverse movement, and a control switch, placed on the right hand side of the rail, controls the direction of traverse. A stop handle is used to determine the height of the slide. In other words, the rails can be rapid traversed to a positive stop, and it is then only necessary for the operator to start the machine after a new set of rails are placed on the table. This stop can be thrown out of place so that when the rear tools need attention the forward slide can be run out of the way. The rear tools are placed in a separate bar that moves simultaneous with the slide and also has rapid power traverse and feeds. The entire clapper box and tool holder are made of steel, and the clapper box studs are fitted in hardened and ground bushings so as to be readily replaceable.

An automatic tool lifter is supplied to the forward slide and also to the rear tools. Movement is obtained by means of an air cylinder operated from the table-shifting mechanism. As can be seen in Fig. 2, the tools are raised high enough to clear the top of the guides so as to prevent any dragging of the tool edges. In the same way the rear tools are raised high enough to go over the top of the guide.

Cutting lubricant is supplied to all of the tools by means of a pump placed on the left-hand side of the machine, as can be seen in Fig. 2, and

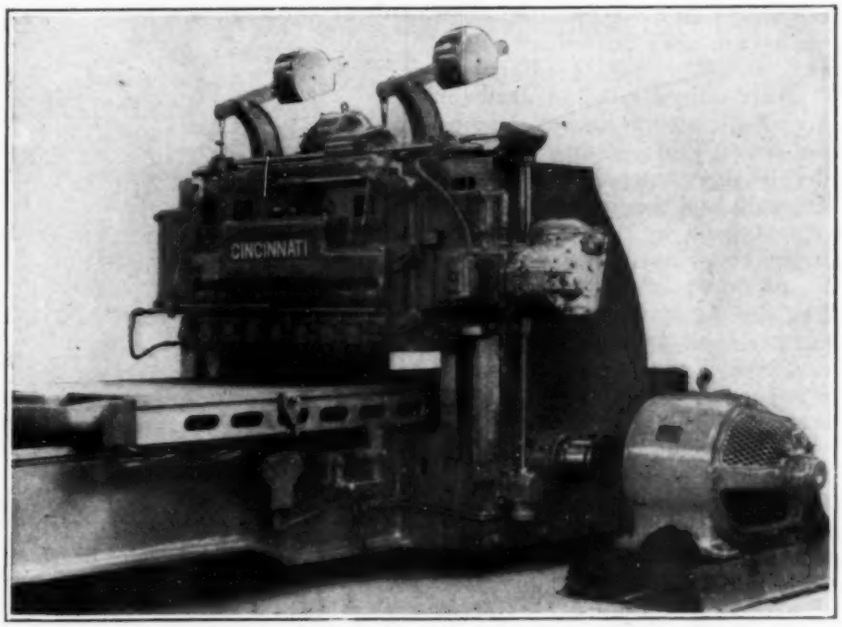

Fig. 1—Cincinnati Rail Guide Planer

Fig. 2—Tools on the forward slide raised by an automatic lifter on the return stroke of the table

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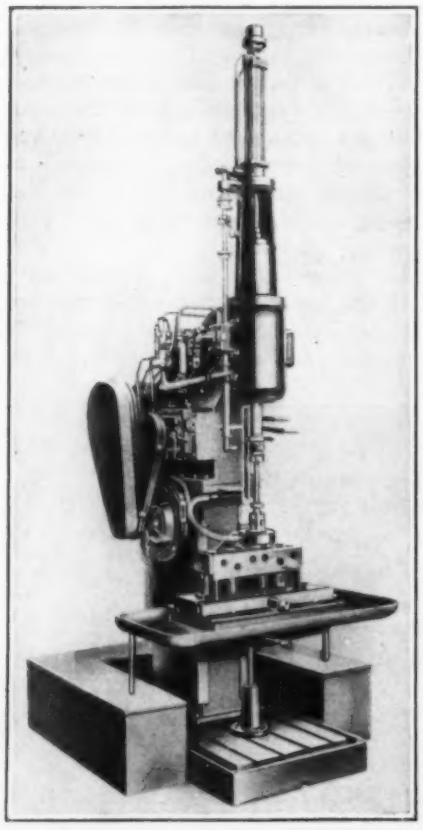
driven from the main drive. When the planer stops the pump also stops. There is also a valve in the line whereby the cutting lubricant is cut off on the return stroke. The coolant is forced into a pipe across the top of all the tool holders and is then led to each one by means of a small pipe. With this construction no more cutting lubricant is used than is necessary.

The gearing in this machine is capable of transmitting 125 hp., if needed, but only an 85-hp. motor drives the machine. This motor has a speed of 500 and 1,000 r.p.m. The resulting cutting speed is 90 ft. per min., and the return speed is 180 ft. per min. At these speeds it will be possible to finish eight rails in about 25 minutes, floor to floor time.

Barnes No. 249 Quick-Change Speed, Single-Spindle Honing Machine

AS IN the case of the No. 212 single-spindle honing machine described on page 837, Vol. 64, of the *American Machinist*, this No. 249 honing machine has a reciprocating spindle hydraulically controlled as to length of stroke. It is made by the Barnes Drill Company, Rockford, Ill. The table does not reciprocate, but an air-operated style of table can be obtained when the 16 in. vertical spindle travel is not sufficient to permit the lifting of the hone out of the work. The air cylinder allows the table to be lowered about 9 in. The regular table has a hand-operated raising screw. The particular feature of the No. 249 machine over the No. 212 is the fact that four or eight quick change speeds are available or one speed only can be furnished. Ball bearings are used throughout as before.



Barnes No. 249 Quick-Change Speed, Single-Spindle Honing Machine

The six-splined spindle operates in a broached cast-iron hub with a steel bevel crown gear. A hydraulic cylinder is superimposed directly over the spindle and the piston is attached to the spindle by means of a ball-bearing coupling. This permits of any spindle stroke desired and assists in setting the spindle stroke so that the hones will extend an equal distance through the bore at each end of the stroke. Stops are used to regulate the stroke.

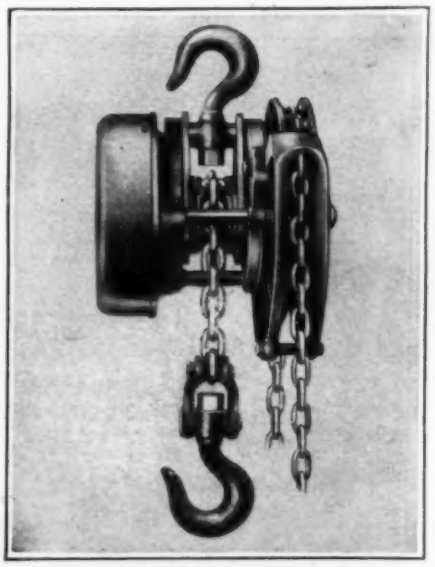
A 5-hp. motor is regularly recommended to drive the machine for honing cylinders up to 4 in. in diameter, and a 7½-hp. motor for larger cylinders. This particular machine will handle bores up to 12 in. in diameter. An Oilgear pump is used to furnish power for the reciprocation of the spindle and may be adjusted to produce 40 to 50 strokes per minute. The standard spindle speeds are 128, 180, 250, and 354 r.p.m. under ordinary conditions. The spindle stroke varies from 1 to 16 inches.

The machine occupies a floor space of about 56x32 in. and 11 ft. 9 in. in over-all height. The maximum distance from the top of the table to the nose of the spindle with a No. 4 Morse taper is 50 in., while the minimum distance is 10⅛ in. The working surface of the regular table is 18x28 in. and it has a vertical travel of 23 in. With the air-operated table, the travel is 6 in. The net weight of the model with motor and starter is 4,300 lb. approximately.

"Ideal" Spur-Geared, Ball-Bearing Chain Hoists

A line of "Ideal" spur-geared, ball-bearing chain hoists was recently placed on the market by the Dickerman Hoist Manufacturing Company, 872 East 72nd Street, Cleveland, Ohio. The gear train is of the planetary type.

In general, the construction is as follows: an endless hand or operating chain passes over a handwheel that turns on the screw hub of a ratchet friction disk keyed to a one-piece drive shaft and pinion. The pinion meshes with two gears held diametrically opposite each other in a pinion cage which is secured, by double keys, to the load wheel that carries the chain load. Integral with these gears are intermediate pinions that mesh with a large internal gear and serve as a fulcrum to rotate the planetary gear. When the pull on the hoisting side of the hand chain loop is discontinued, a pawl engages the ratchet disk, preventing the load from lowering. A pull on the lowering side of the hand chain unscrews the hand chain wheel from the hub of the ratchet disk, thus releasing the drive shaft and permitting the weight of the load to rotate the planetary gear. The downward speed of the load is always in direct proportion to the rapidity with which the operator overhauls the hand chain.



"Ideal" Spur-geared Ball Bearing Chain Hoist

In sizes over ten tons, two gear

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trains are used and are contained in separate cases connected by a yoke. These trains are operated by separate hand chains, but have a single hoisting hook.

Ball bearings are used wherever possible and are protected by armored felt washers against the entrance of dirt and abrasive matter. By means of oil ducts the oil is delivered direct to the ball bearings in the pinion shaft bearings. The hoist is made almost entirely of steel, including the load wheel, suspension plate, top hook, cross head, load hook shackles, and the driving pinion shaft. The load chain is electrically welded and each link is formed to dies to secure uniformity.

The driving pinion and shaft are made from a steel forging of special analysis. The pinion teeth are accurately cut from a solid blank and shaft is turned and ground to size. To prevent breakage under severe stresses, and shocks the pinion case is made of tough, malleable iron with a large factor of safety. The gears and pinions are made from a special alloy and the teeth are cut from machined blanks.

Ideal hoists are furnished in capacities from ¼ to 10 tons with lifts varying from 8 to 12 ft. The pull on the hand chain to raise the rated load varies from 47 to 132 lb. The hoist is also made in 16-, 20-, 32-, and 40-ton sizes.

Artos Automatic Wire Measuring, Cutting and Stripping Machine

WIRES can be automatically cut to length and simultaneously stripped of insulation from both ends at a high rate of speed in the machine shown in Fig. 1, made by the Artos Engineering Company, 69 Wisconsin St., Milwaukee, Wis. The only function of the operator is to load the machine with a coil of material and remove the finished wires. The machine has a production of 3,600 pieces per hour and can handle insulated wires and cords with an outside diameter up to ⅜ in. Two types of machine are made, one with a maximum cutting length of 30 in., and the other of 60 in. They are furnished equipped either for belt drive or with individual electric drive.

In principle, the machine consists of two traveling clamps and two tool holders as can be seen in Fig. 2. The clamps carry two interlocking fingers, which open and close. When closed, the clamp is free to pass between the tools, and when open, it can pass the other closed clamp and also the tool holders. Both clamps are driven by the same cable and receive the same movement but in opposite directions. The tool holders each carry one cutting blade in the middle, and two

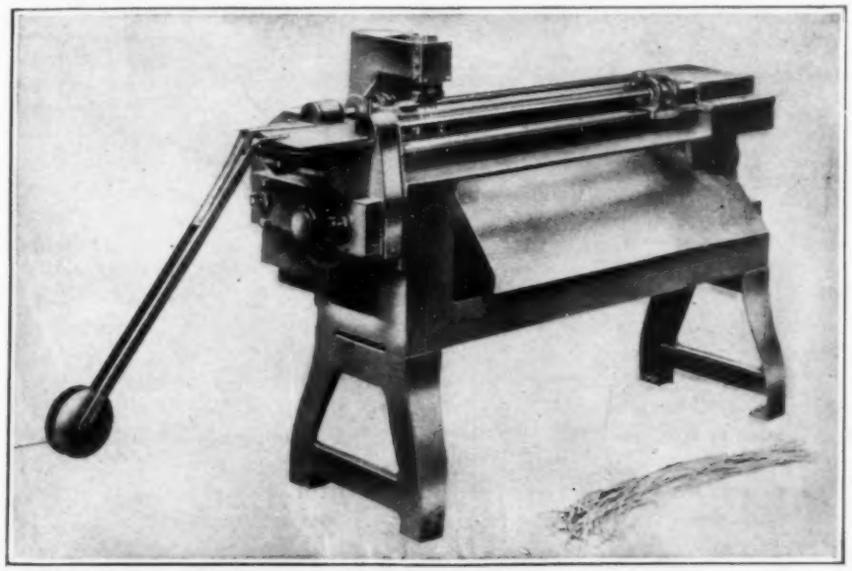

Fig. 1—Artos Automatic Wire Measuring, Cutting and Stripping Machine

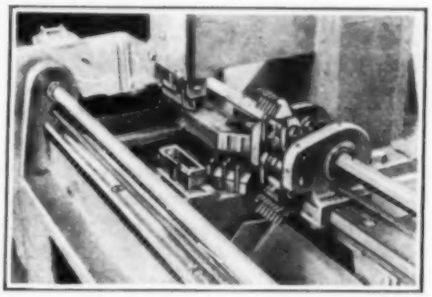

Fig. 2—The clamps and tool holders

stripping blades, one on each side of the cutter. The cutting blades pass each other and cut off the wires, while the V-shaped stripping blades cut through the insulation only.

The operation of the machine is as follows: One clamp grips the material on the left side of the cutter head, passes the tools, and pulls the wire out to the given length. The other clamp simultaneously moves over to the left side and grips the wire. The wire is now held with both clamps and in this position the cutting tools move together, severing the wire with the middle tool and cutting through the insulation with the others. Next the clamps move apart and allow the severing tools to pull the insulation from the ends of the wires, after which the tool holders separate again and eject the strippings. The first clamp then opens and drops the finished wire through the machine and down into a receptacle.

When the first clamp moves back, the second clamp pulls out with a new piece and the first clamp then grips the wire again on the left side as in the first instance. While the feeding stroke can be adjusted to any length of wire within the limits of the machine, the stripping stroke remains constant and always comes at the proper time, regardless of the position of the clamps. Different stripping lengths can readily be obtained by adjusting the space between the cutting knife and the stripping knives. The pressure on the clamp fingers is easily adjusted by means of right- and left-hand screws. These clamps are opened and closed by means of a toggle system in which the connecting rods are made of springs in order to give flexibility. The clamps form a self-contained unit.

The equalizing lever attached to the left end of the machine keeps the reel spinning and prevents excessive jerks when feeding the material.

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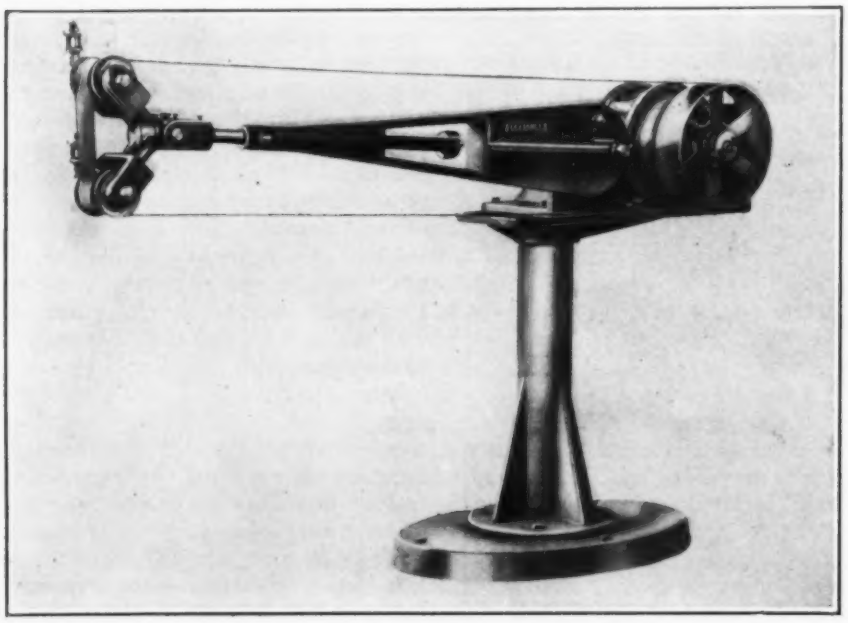
Defiance No. 726 Motor-Driven Flexible Belt Polishing Machine

CURVED surfaces, such as automobile steering wheel rims, closet seats, mirror frames, and irregularly-shaped metal parts can be finished with the No. 726 motor-driven flexible-belt polishing machine made by the Defiance Machine Works, Defiance, Ohio. This machine is regularly furnished with one 2-in. polishing belt prepared and ready for use. By substituting larger pulleys, it is possible to adapt the machine for use with wider belts, according to the requirements. The belts are 148 in. long and afford a liberal amount of polishing surface.

The frame, of the pedestal type, is a substantial casting with a cored center and a broad base to insure proper support of the working parts and to prevent vibration of the machine while it is in motion. The adjustable arm, which supports the two idler pulleys over which the polishing belt travels, can be set in any desired position to suit the convenience of the operator and the character of the work being performed.

The V-shaped yoke that supports the idler pulleys is fitted to a ground steel spindle, which slides through a substantial bearing. The travel of the spindle is controlled by coiled steel springs located on each side of the arm and attached to an adjustable collar fitted to the spindle. This construction provides the proper amount of flexibility and tension to the polishing belt. The idler pulleys, $3\frac{1}{4}$ in. in diameter by $2\frac{1}{2}$ in. face, are supplied with improved self-oiling devices so constructed as to prevent the admission of dust or dirt into the bearings. These pulleys are located a convenient distance apart to allow the work to be held in any angle to permit the polishing belt to reach all the surfaces to be finished.

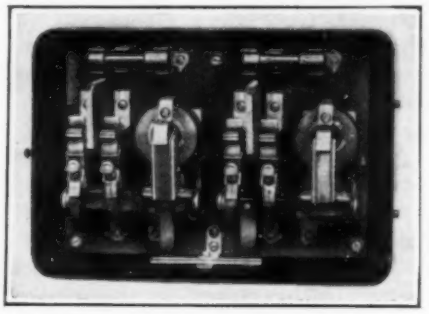
All the running parts are accurately balanced to eliminate vibration and to permit the polishing belt to be run at a speed of 5,000 linear feet per minute. The machine is regularly furnished with a 2-hp. motor with starter. The floor space occupied by the machine is 76x26 in., and its domestic shipping weight is 604 pounds.



Defiance No. 726 Motor-Driven Flexible Belt Polishing Machine

General Electric Small Reversing Switches

Three small switches for miscellaneous applications, such as across-the-line reversing switches for small motors, are announced by the General Electric Company, Schenectady, N. Y. The CR-7009-F-1 and F-2 switches each consist of two 15-amp. double-pole contactors electrically and mechanically interlocked and inclosed in a drawn-shell case. They are for use with momentary-contact, push-button stations. The F-1 form is without overload relays, while the F-2 form has Trumbull overload relays.



General Electric Type CR-7009-F-2 Reversing Magnetic Switch

The CR-7009-B-10 switch consists of two three-pole, 25-amp. contactors mechanically and electrically interlocked. The switch is for use with a momentary contact push-button station and has Trumbull overload relays. As in the case of the previously mentioned models, this switch is also inclosed in a drawn-shell case. The switches are recommended for application wherever a small magnetic reversing switch is required, such as the control of machine tools, motor-operated valves, and the like.

"Morco" Drop-Forged Conveyor Chain

"Morco" drop-forged conveyor chain is being made by the Moore Drop Forging Company, Springfield, Mass., in both open-link and closed-link types for general use on drag lines, bucket or floor conveyors, or monorail installations. Either malleable or drop-forged attachments such as scrapers, pushers, trolley extensions, car hauls, bucket attachments and the like can be furnished. The malleable attachments are secured to the center of the links by means of bolts, while drop-forged attachments are formed integral with the side links.

The chain is of patented construction and has a center link and a side link. It can be easily taken apart or assembled without the use of tools. It is impossible for the links to

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buckle or come apart in service, and it has great tensile strength per unit weight. Its light weight results in power saving. The elimination of the use of pins is an advantage in handling coarse materials where wear would be augmented.

Each link engages with the sprocket teeth so that an even pull is produced. The chain is designed to fit nearly all standard sprockets. It is made of special high-carbon steel and is said to be resistant to the corrosive effects of sulphur water or acidulous ores after it has been forged.

Additional Sizes of Hobart Test Benches

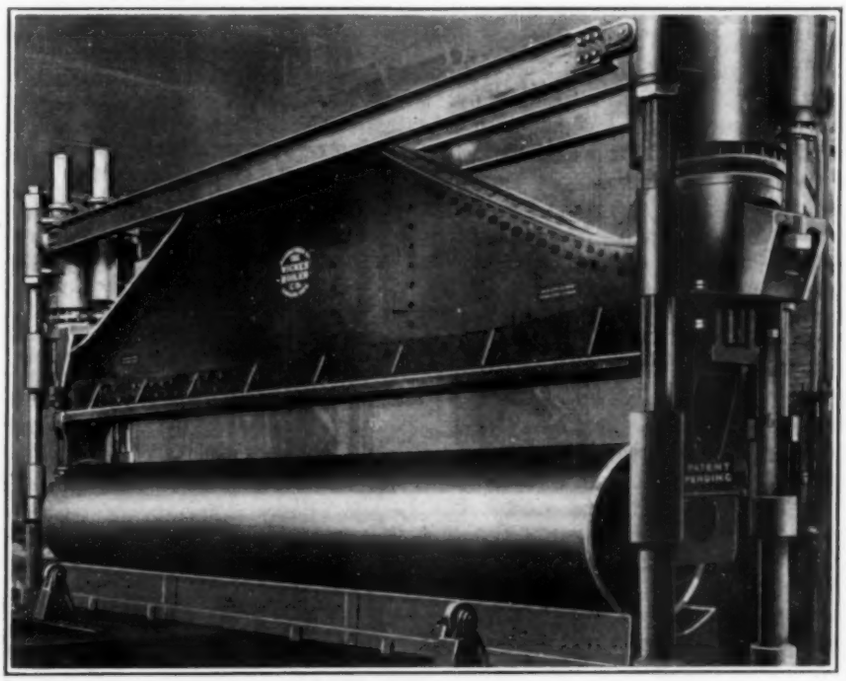
Announcement is made by the Hobart Brothers Company, Troy, Ohio, of the addition of two sizes to its line of test benches, the 1½ and the 2-hp. size. These two benches have the identical features of the 1½-hp. outfit which was described on page 218, Vol. 64, of the *American Machinist*. The benches are used in determining ignition, starting, and lighting troubles.

Wickes Forming Press for Boiler Shells

THE large hydraulic press shown in the illustration was recently designed by the Wickes Boiler Company, Saginaw, Mich., for use in forming boiler shells in their own plant. Because of its general utility, however, it has now been placed on the market. The press has an open span between posts of 30 ft. and is capable of producing a pressure of approximately 3,000,000 pounds.

The machine was originally designed for flanging wide boiler headers and for forming butt straps and the ends of the shell plates to the proper curvature in one operation. It was then found that by slight modification the unit could be used to press a drum shell from a single plate leaving but one longitudinal seam. Heretofore, on account of the increased size and thickness of plates for drums in large water tube boilers, it was impossible to use bending rolls to form cylinders of small diameter. The procedure used was to form the shells in halves and rivet them together. This machine therefore eliminates one seam.

In order to accomplish this purpose a large forged-steel stake or mandrel with special attachments for handling was applied to the press. The mandrel is 36 in. in diameter and weighs over 100,000 lb. It is made of an alloy steel of high tensile strength. Cast steel forming dies rest on the lower platen of the press. In the photograph a shell is shown in the press after it has been formed. The drum shell is 48 in. in diameter, has a thickness of 1⅞ in., and is approximately 29 ft. long. It was used in the construction of a Wickes three-drum curved tube boiler.



Wickes Forming Press for Boiler Shells

"Namco" Chaser Grinding Fixture

For the uniform grinding of chasers used in "Namco" thread-cutting tools, the National Acme Company, Cleveland, Ohio, has developed the fixture shown in the accompanying illustration. Because of its simplicity in operation, this fixture can be used on any grinding equipment fitted with a table, and by means of carefully graduated adjustments, it is possible to obtain uniform and accurate chaser grinding.

A set of five adaptors furnished with each fixture takes care of the entire range of chasers used in Namco

"Namco" Chaser Grinding Fixture

self-opening dieheads. Changing of these adaptors in the adjustable holder is simple: two hollow setscrews hold both the adaptor and the chaser firmly in place during the grinding operation, and by loosening these two screws, the operator can remove both pieces.

This fixture is readily fastened to the table of any grinding equipment. The indexing plate is adjustable for swing to an angle of 90 deg. in each direction. The holder for the adaptors is also adjustable and is graduated for work at various angles such as is required for the grinding of the chaser throat or chamfer. In fact both the face and the throat of

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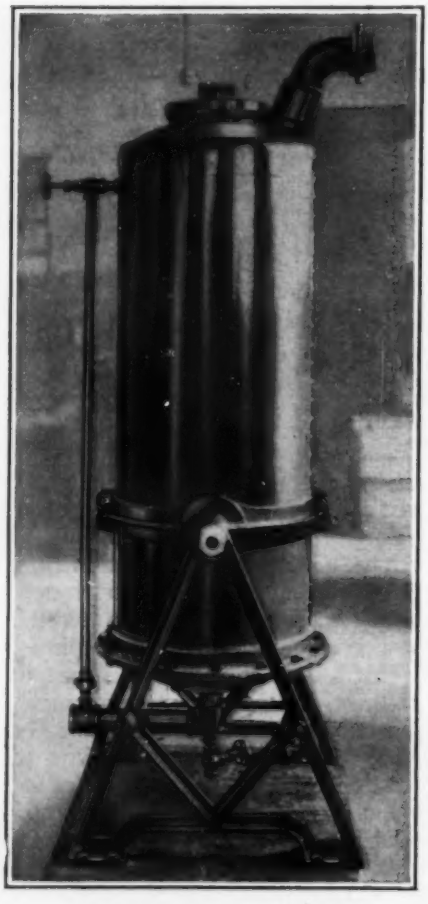
the chaser can be ground with only one wheel because of the flexibility of the fixture and its numerous adjustments.

On a chart that accompanies the fixture is listed the proper angle for grinding the chaser face, throat or chamfer as required for various materials to be threaded, correct cutting speeds, and also the proper lubricant as recommended for thread cutting. Information as to the use of different wheels for various chaser sizes is also listed.

"Phomene Accumulator"

A device for extinguishing fires in oil, gasoline, paint, lacquers, and other inflammable liquids has recently been placed on the market by the Pyrene Manufacturing Company, 560 Belmont Ave., Newark, N. J., under the name "Phomene Accumulator." The principle of operation is the smothering of the flame with large quantities of foam.

The pipe at the bottom of the accumulator tank is connected to the water supply, and a foam distributing line is run to the hazard. In the accumulator is placed a charge of dry powder. When the valve in the water line is opened, either automatically or manually, foam is generated. It is possible to operate the valve by a thermostatic device located at the hazard.



"Phomene Accumulator"

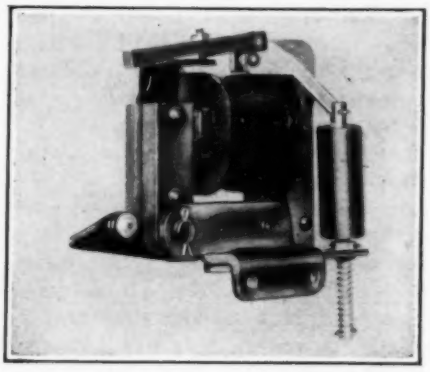
Dry powder has been used because it will not deteriorate, and because of its saving in space. Also, it cannot freeze; hence special heated housings are unnecessary. It does not evaporate or decompose and is not subject to bacterial growth.

The Phomene accumulator holds 275 lb. of powder, and delivers 2,400 gallons of foam at average water pressure and temperature. The foam produced is durable and tenacious, but free-flowing. It floats on liquid surfaces and adheres to solid surfaces, horizontal or vertical. The foam is neutral and it is claimed that it is harmless to persons, oils, varnishes or other merchandise, and that it will not discolor or bloom the clearest oils. The foam will remain for a long while as a protective blanket over the oil surfaces without breaking down or being dissipated.

Westinghouse Time-Delay Device for Low-Voltage Release

For those electrical applications that are liable to voltage drops of short duration, the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has designed a time-delay attachment for use on standard low-voltage release equipment. This attachment is of particular advantage in continuous process work where it would be a great inconvenience to have the motors of the plant shut down due to momentary dips in voltage.

The time-delay device is provided with an adjustment that allows the low-voltage release to open only when from one-half to two and one-half seconds have elapsed after the voltage drops below the minimum value. If the voltage remains low for a period longer than the time for which the time-delay device is set, the motor circuit will be opened and the equipment protected from excessive current. This device will keep motors from shutting down due to short surges caused by temporary short-circuits and "bumps" due to switching. The usual method of starting and stopping with the auto-starter handle is not affected in any way by the addition of the time-delay attachment.



Westinghouse Time-Delay Device for Low-Voltage Release

The attachment consists of a low-voltage magnet with a dashpot for retarding its opening. After opening slowly a certain distance, a latch releases the magnet so that the starter opens quickly in the usual way. The time adjustment is obtained by varying the position of the fulcrum of the release latch. The dashpot is mounted with the open end down so there is no danger of getting dirt into it.

Trade Catalogs

LATHE. The Porter-McLeod Tool Works, Hatfield, Mass., has issued a leaflet describing its motor-driven, 12-speed, geared-head engine lathe. The principal characteristics of the machine are pointed out and specifications are given. The circular is illustrated.

LUBRICATORS. The Madison-Kipp Corporation, Madison, Wis., has reprinted in leaflet form two of its recent advertisements. One shows the application of the Madison-Kipp fresh-oil system to the traverse mechanism and feed train on the new Gisholt "2L" heavy-duty turret lathe. The other illustrates the application of the system to the new chucking machine made by the New Britain Machine Company.

TRAMRAIL SYSTEMS. The Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, issues from time to time circulars describing applications of its tramrails in various industries. In the present bulletin, No. 558, various types of tramrail carrier systems are shown with the aid of numerous photographs of typical applications.

NEWS OF THE WEEK

Foundrymen Plan Special Study of Production Costs in their Industry

Told they are backward in scientific development

ANIMATED discussion of the future of the foundry industry, and the elaboration of a program of education along the open shop lines fostered by this body, featured the thirty-first annual meeting of the National Founders Association, held at the Hotel Astor, New York City, Nov. 16 and 17. Over two hundred foundry executives attended this meeting, which was said to be the largest attendance in several years. William H. Barr, of Buffalo, who has been president of the association for many years, presided at all the sessions.

Why Foundries Lose

Probably the outstanding address of the convention was that delivered by E. T. Runge, of Cleveland, whose subject was "Seven Reasons Why Many Foundries Operate at a Loss." Mr. Runge, who is known in the foundry industry as an expert on production costs, gave a most practical analysis of present foundry cost problems. He declared that 90 per cent of the foundries operating today do not know how to base their costs correctly and that the growing practice of selling castings at below cost was the greatest evil in the industry. In answer to those who might dispute this latter statement he went into great detail to prove that there never was a pound of iron castings sold at below cost that helped the foundry industry. Most of Mr. Runge's address was made up of a comparison of detailed costs for grey iron castings and he quoted figures to back up each of his arguments. Many of his remarks provoked discussion after he had finished and the interest of the audience in cost matters was evident from the number who desired to question the speaker.

Another address that stood out was "The Foundry of Tomorrow," by E. A. Custer, Jr., of Philadelphia. Mr. Custer traced the history of the foundry industry from early ages through the development of malleable steel and the invention of mechanical means of forming metal. He spoke highly of a German steel that was introduced into this country recently and expressed disappointment that American manufacturers had been backward in accepting it after proof had been given of its worth. He stated that he witnessed a test of this metal in which an ordinary pipe nipple was subjected to a pressure of 2,910 lb. without showing strain. Mr. Custer endeavored to get across the idea to his audience that American foundrymen are backward in adopting improved methods and processes. He pleaded for more scientific knowledge of foundry practices and insisted that this was necessary if the foundry industry in this country was to progress and compete with the rest of the world.

James A. Emery, counsel of the association, gave a very interesting discussion of the "Trade Unions Reform Bill" which went into effect in Great Britain on July 27 last. Mr. Emery spent some time in England this summer studying this law and gave the members of the foundry industry some first-hand information on the causes that led up to the adoption of this law, and the results that are expected to come from its enforcement in the future. His outline of the law showed that it was aimed to prevent any repetition of a general strike such as the one last year that crippled British industry. It also covers sympathetic strikes and provides punishment for any kind of coercion either on the part of employer or employee. Mr. Emery cautioned the foundrymen to watch the activity of the American Federation of Labor, which recently announced its intention of fostering a law to prevent the use of the injunction in labor troubles.

The increasing encroachment of Government in the realm of business was the subject of a spirited address by Gen. R. C. Marshall, manager of the Associated Contractors of America. General Marshall spoke of the construction work and other business activities of the government—federal, state and municipal—and cited instances where such work cost more than that done by private contractors, thus adding to the tax burden of the people.

A plea for industrial co-operation with the Better Business Bureau was voiced by George Gordon Battle, prominent attorney, who outlined the advantages of such co-operation in the prevention of investment frauds in industrial matters.

S. Wells Utely, president of the American Foundrymen's Association, brought a message of co-operation from the sister organization of the national association. His address dealt with the place of the foundry in the present scheme of industrial development.

Melville White, president of the Canadian Foundry and Metal Trades Association, responding to a call from the chairman, addressed the convention. He paid tribute to the co-operation between American and Canadian industry and was optimistic over the future of the foundry in his country. He quoted some figures showing the remarkable industrial development of Canada in the past few years.

Col. William Frew Long, general manager of the American Plan Association, of Cleveland, gave an illustrated lecture on labor conditions in that city, showing by lantern slides some of the acts of vandalism claimed to have been perpetrated by opponents of the open shop plan. In his address Col. Long declared that the future battle of the open shop would be fought politically—not industrially.

Among the resolutions adopted at the conclusion of the meeting was one empowering the executive committee to appoint a special committee to study the subject of foundry costs, and to discover new products for the foundry. Another resolution provided for the contribution of $5,000 to the fund to promote better understanding between industry and agriculture, and $1,000 to the National Industrial Conference Board.

The election of officers resulted in the re-election of William H. Barr as president. C. S. Koch of the Fort Pitt Foundry and Machine Co., McKeesport, Pa., was elected vice-president. A. E. McClintock, of Chicago, was again appointed commissioner, and J. M. Taylor secretary.

Advisory Committee on Merchandising

The executive committee of the Power Transmission Association has announced the appointment of a merchandising advisory committee to study advertising and merchandising problems relating to the sale of power transmission products. The present personnel of the committee is as follows: Chairman, William W. French, Dodge Manufacturing Corporation, Mishawaka, Ind.; J. R. Hopkins, advertising manager, Chicago Belting Co., Chicago; W. W. Warr, Manhattan Rubber Co., Passaic, N. J.; E. T. Cregier, sales manager, Medart Co., St. Louis; Wylie K. Lee, president, Clipper Belt Lacer Co., Grand Rapids; H. M. Carroll, advertising manager, Hyatt Roller Bearing Co., Harrison, N. J.; Russell C. Ball, president, Philadelphia Gear Works, Philadelphia; F. E. Barth, vice-president, Graton & Knight Manufacturing Co., Worcester, Mass.; E. A. Emmons, sales manager, Foote Brothers Gear and Machine Co., Chicago.

Installment Selling Sound Research Shows

Installment selling not only is a sound method of financing the distribution of merchandise, but has proved itself one of the most potent agencies in shaping the new prosperity of the United States, an agency that has increased production, stabilized output, reduced production costs and increased purchasing power throughout the country. This is the conclusion reached by Edwin R. A. Seligman, professor of political economy at Columbia University, and laid before 500 of the leading financiers, business men and economists of the nation assembled at a dinner in his honor in New York on Nov. 17. Professor Seligman's study is said to have been the most exhaustive ever undertaken.

This research in the field of "consumer credit" has occupied fifteen months and the labor of a large staff of associate economists at Columbia. It was entered on nearly a year and a half ago at the request of the General Motors Corporation, whose officials felt that the question was of such vital importance to the community that it should be explored scientifically in all its economic aspects.

The Columbia economist, although limited by time to touching the outstanding points of his investigation, produced conclusions on a number of controversial points of the installment selling question.

His findings are considered particularly important by industrialists and national merchandisers because of the widespread use of the "time payment" principle in numerous important lines, some of which depend almost entirely on this method of distribution.

Engineering Memorial in Louvain Library

During the World War many American engineers served overseas in the forces of the United States of America and the Allies. A considerable number of them gave their lives, and for them the American societies of civil, mining and metallurgical, mechanical, and electrical engineers will create a memorial by donating to the University of Louvain for its new library building the clock and the carillon of bells for its tower.

With these exceptions of the clock and the carillon, the funds for this building have been provided by gifts from approximately a million Americans—school children and teachers, college students and professors, policemen, firemen, men of means and organizations in all parts of the country. The new Louvain Library, of which Mr. Whitney Warren, of New York, is architect, will be dedicated next May or June to replace the ancient library destroyed during the war with its priceless books and its old carillon.

Dr. Edward Dean Adams, of New York, honorary member of engineering foundation, ascertained the lack of clock and carillon last June while in Louvain as delegate from four American engineering societies, Engineering Foundation and Engineering Societies Library, to the celebration of the 500th anniversary of the university. Upon his return he proposed that these objects be given by the societies as a memorial to the American engineers who had made the supreme sacrifice. The proposal was enthusiastically received and a committee was appointed to represent the societies in carrying the project through.

American Firm Will Build Rail Repair Shops in Turkey

A contract involving approximately $2,500,000 has been entered into between the Fox Brothers International Corporation of New York and the Turkish government, it was announced last week by John J. Teal, vice-president of the corporation. The contract calls for the construction and equipment of car and locomotive repair shops at Kaisaria, Turkey.

Kaisaria, where the construction work will be done, is one of the chief junction points of the new railroad which will link Angora, the new capital of Turkey, with Kaiseria, Sivas and Samsun. According to the contracting firm, the Angora, Kaiseria, Sivas & Samsun Railroad will not only open up to commerce the richest agricultural section of Turkey, but will serve likewise to link the Turkish capital with Persia and the Bagdad Railway.

It is thought that American railway equipment companies might be associated in the present undertaking. Inquiries for bids will be issued early next year for all essential items of railway equipment for the new line. Competition in this direction, it is said, will be extremely severe. Germany has long handled Turkish railway building and German rails and equipment have long been the standard in the country.

Indiana S.A.E.

Approximately 100 automobile engineers from Indiana and Michigan were at Anderson, Ind., recently for the November conference of the Indiana division of the Society of Automotive Engineers. With the engineers were several manufacturers of automobiles and accessories. Among the speakers were Fred Deusenberg, of the Deusenberg Motor Co., and H. Lytle, chief engineer of the Marmon company. A party of twenty-five engineers and manufacturers came from Detroit, representing various automotive manufacturers.

A luncheon was given for the visitors at the Grand Hotel followed by inspection of the Delco-Remy plants. At night the engineers were guests at a dinner at the Grand Hotel. The principal talk was made by C. E. Wilson, president and general manager of the Delco-Remy Corporation.

New England Council Third Conference

Much of interest to the machine industry and to manufacturers in general developed at the third New England Conference, held in Springfield, Mass., Nov. 17 and 18. Nearly 1,000 delegates and guests of the New England Council attended the sessions which were held in the Municipal Auditorium.

The Metropolitan Life Insurance Co. presented reports on an industrial survey of New England. Other surveys are in progress covering such fields as public relations, community organization, relation of business to industry, power, agriculture, recreation in industry, industrial management, taxation, marketing and advertising.

Numerous papers on the subject demonstrated that the New England business is fully sold on the value of research as an indispensable aid to production and marketing.

Col. Frederick Payne, president of the Associated Industries of Massachusetts, and of the Greenfield Tap and Die Corporation, called for intelligent study of sales costs. He urged greater attention to advertising and said, "There never has been a period in the history of the country when so much machinery was sold or scrapped as in the past six years, particularly in New England," in an effort to improve quality and lower costs.

Speaking of the new attitude in management, W. E. Freeland, president of Freeland & Warren, Inc., challenged industrialists to study most carefully those things now taken for granted. "Management is expected to use research to keep abreast or ahead of competition," he said, "and the highest technical skill is available to the little business as well as to the big one. There is need for a new attitude toward industrial co-operation. Secrecy and selfishness eventually produce anemia in management, reflected by the dividends of its business."

James W. Hook, president of the Geometric Tool Co., New Haven, told how a precision tool business was completely rejuvenated by the intensive application of sound management principles. Inventories were cut by standardization of the product. Old machinery was junked and replaced by the most efficient obtainable. Higher standards of accuracy were set up. Workmen became stockholders and were encouraged to offer suggestions. Sales methods were revolutionized. Today the business is flourishing.

Aviation as a field for New England manufacturers was discussed by Prof. W. G. Brown, of the Massachusetts Institute of Technology.

Ford in Japan

A contract for building a $1,000,000 branch Ford plant in Yokohama, Japan, with a capacity of 200 cars a day, has been awarded to the H. K. Ferguson Co. of Cleveland, Ohio. Work will be started immediately on the factory, which will be an assembling plant for both Fords and Lincolns. It is expected to be completed by August, 1928.

Special Tests to Learn Wear of Plug Gages

Considerable difficulty has been experienced in securing from service wear tests of plug gages information concerning the wear resistance of different metals, on account of the many variables normally encountered in shop gaging practice. It has likewise been exceedingly difficult to secure data which would adequately define the conditions under which any test gages might have been used.

H. J. French, of the Bureau of Standards, recently described before the American Society for Steel Treating a laboratory wear tester designed for plug gages. This machine, which provides for the repeated insertion and removal of plug gages from rings representing the "work" has been found to give consistent results because of the possibility of closely controlling the gaging conditions. Preliminary experiments, previously reported, indicated that the results secured were also consistent, under certain conditions, with experience in practical service.

The supplementary and more extended tests considered in the present report, in which tests gages were used without abrasives in file hard high carbon steel, an aluminum "piston alloy," and a cast iron containing appreciable proportions of pearlite, showed that chromium plated steel gages had the highest resistance to wear. Ammonia treated chromium aluminum steel, marketed under the name "Nitralloy," was second in resistance to wear and much superior to the remainder of the group which showed variations but no radical differences in performance of the individual metals. In general file soft steels showed somewhat better resistance to wear than corresponding steels in the file hard condition and this difference was most noticeable in an oil hardening tool steel.

In tests made in the presence of a non-metallic abrasive, Stellite, a high-carbon high-chromium iron alloy and chromium plated gages showed better resistance to wear than the customary high carbon steels or the Nitralloy.

Rail Safety Tests at Purdue

In an effort to improve the reliability, efficiency and safety of railroad service, the American Railway Association, in conjunction with the Interstate Commerce Commission, is conducting at Purdue University, Lafayette, Ind., two of the most extensive engineering investigations ever carried on by the rail carriers. One investigation is being conducted for the purpose of determining what improvements, if any can be made in the present standard freight train airbrakes, while the other is to ascertain what improvements can be made in the draft gears.

The airbrake investigation, which is being made under the supervision of H. A. Johnson, director of research of the mechanical division, American Railway Association, is being conducted in a special building, where airbrake equipment equivalent to that used on two locomotives and a hundred car train has been stalled on test racks.

In connection with the draft gear investigation, the American Railway Association constructed a draft gear testing laboratory at Purdue and installed therein a testing machine especially designed and constructed for this purpose. Tests will be made of the various draft gears commonly used on railway cars.

New Aircraft Carrier Is Commissioned

The "U. S. S. Saratoga," airplane carrier just completed by the Brown-Boveri Electric Co. at its plant at Camden, N. J., was formally commissioned at a brief ceremony at Camden on Nov. 16. The ceremony took place on the deck of the huge vessel, which is the largest and fastest craft built for the Navy and which cost $45,000,000.

C. L. Bardo, senior vice-president of the company, addressed the gathering from a hollow square formed by Marines on the deck of the vessel and formally turned the ship over to Admiral Julian S. Latimer. Mr. Bardo sketched the history of the vessel from the time her keel was laid in 1920 to her launching and christening by Mrs. Curtiss D. Wilbur, wife of the Secretary of the Navy on April 7, 1925.

There are some mechanical devices not before found on a vessel, among them being the ramlike catapult used for launching planes. A powerful radio transmitter, range finding devices and four 8-in. range rifles, comprise part of the equipment. In Quincy, Mass., a sister ship of the "Saratoga" is being constructed.

Chicago A.S.M.E.

An attendance of over five hundred engineers marked the aviation meeting of the Chicago Section of the American Society of Mechanical Engineers, held on Friday, Nov. 11. The principal speaker was Charles M. Schwab, president of the society. Mr. Schwab did not, however, speak on the subject of aviation, but delivered a somewhat philosophical address on life, and the aims and ambitions of the busy industrialist.

Lester D. Seymour, chief engineer of the National Air Transport, Inc., presented a paper, "The Engineering Problems of Air Transport," in which he covered the development of aircraft, air routes and the industry as a whole. Other speakers were W. L. Abbott, past president of the A.S.M.E., and the chief engineer for the Commonwealth Edison Co., of Chicago; Thomas Wilson, Western editor of *Power*; C. B. Cole, of Chicago; and Calvin W. Rice, secretary of the A.S.M.E.

Production of Railway Equipment Low

Production of railway freight cars in the first nine months of 1927, as reflected in the reports of units placed in service, declined fully 31 per cent as compared with the total for the corresponding period of 1926, which, moreover, was one of the most unsatisfactory periods for most manufacturers in a number of years. Unfilled car orders on Oct. 1 were also somewhat under those of a year ago and new orders have not been received during the current month at a rate indicative of any early improvement in the car manufacturing situation. Earnings of leading manufacturers will make a decidedly unsatisfactory showing for the year as a whole, says the Standard Statistics Company.

Locomotive production in the first nine months of 1927 ran about 10 per cent under that of a year ago. New orders booked in the third quarter of the year were at the rate of only about 5 per cent of the industry's manufacturing capacity. Unfilled orders in this branch of the industry on Oct. 1 called for only 134 units, as compared with an order total of 443 on the same date a year ago. Both American Locomotive and Baldwin will probably report moderate earnings on their common stock owing to the income from other sources, but this will not be sufficient to cover divided requirements. From a manufacturing standpoint the locomotive industry is in a seriously depressed condition.

Foreign Machine Trade

The British engineering trades show some slight improvement, according to a cable from Commercial Attaché William L. Cooper, London. Foreign orders for textile machinery are satisfactory but the domestic demand is disappointing. The machine tool trade is slightly better. German official trade returns reveal that German exports of internal combustion engines during 1925 were considerably higher than her last prewar year's exports, but that during 1926 a decided falling off in these exports took place. Exports of stationary internal combustion engines for 1927 will probably show a slight increase over those of 1926, and so probably will exports of parts. Of the total German exports of internal combustion engines, from 75 to 80 per cent are accounted for by stationary engines.

There is fair activity in the textile machinery trade of Australia, especially in knitting machinery, according to a cable from Trade Commissioner Earl C. Squire, Sydney. The trade in woodworking machinery, however, is dull. September imports of machinery into New South Wales, excepting electrical and agricultural, reached a total value of £289,900, of which the United Kingdom supplied 60 per cent, the United States 28 per cent, and Germany 3 per cent. In general, the machinery trade during September was somewhat dull in spite of the figures quoted.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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IT IS a law of physics that action and reaction are equal but in opposite directions. Presumably, the same law applies to business, but as a practical matter its reactions are rarely equal to the forward movements that have preceded them because the force of the former is largely absorbed by the optimism and recuperative energy of mankind. Hope is normal; despair is exceptional. Men are naturally constructive. Most of them would rather buy than sell, and build up rather than destroy.

Therefore periods of declining prices are generally shorter than those of booms, and hard times do not last as long as good times. These observations are prompted by the recovery from the recent decline shown in the stock market last week. There were many who expected that prices would go back to nearly where they stood when the "Coolidge boom" started in 1925, but the prevailing optimism and easy money have been too much for the bears and they have had to retreat.

The theory upon which securities are being rebought is that the business reaction has exhausted itself, and that the expenditure of the enormous sums now being borrowed will soon quicken the wheels of industry and provide reemployment for any who were thrown out of work last summer. Attention is called to the fact that 89 municipalities borrowed $31,000,000 last week, and that on election day the people of the state of New York authorized an increase of $300,000,000 in the debt limit of the city of New York so that new subways could be built without further delay.

It is urged that all this money, with other hundreds of millions for which other borrowers are negotiating, will be put into circulation very soon, and that by next spring the factories and steel mills will be running at capacity to meet the demand created.

As against these optimistic predictions, the only counterweights to be considered are the continued increase in the loans against securities which reached a new high record last week, and the additional exports of gold that are foreshadowed by the advance in sterling and guilders.

But we can well afford to send a substantial portion of our surplus gold to those who need it more than we do, and there is a confident belief that the outflow will be so controlled that it will do no harm. The faith of business men in the ability of the government to keep the country out of economic trouble is indeed one of the most striking features of the present era.

It was well expressed by Abram F. Myers of the Federal Trade Commission in an address recently delivered at a Southern trade convention when he prophesied that the traditional business cycle will soon become archaic because it will be prevented by the "stabilization of the money market through wise banking regulation, the gradual stabilization of production through the dissemination of statistics and other lawful activities of the trade organizations, the simplification and standardization of production and products, and the introduction of new wealth-producing activities faster than the old ones are depleted or reach the saturation point."

This optimism may be unwarranted and there is grave doubt of whether the government paternalism that inspires it is desirable, but it is no longer a theory, it has become a condition, and as such it cannot be ignored by the conscientious student of economic history. On the other hand it must be admitted that the commodity markets do not yet manifest the spirit of levitation that is so apparent on the Stock Exchange.

Two of the more important staples, rubber and coffee, are already under partial or complete government control, and insofar as they are concerned, the law of supply and demand has been arrested in its operation.

The heaviness in cotton is also due to the chilling influence of government interference indirectly exerted through the agency of crop reports issued and to be issued. Just now there is a fear that the estimate to be published Dec. 8 will indicate a yield of over 13,000,000 bales, and buyers of both raw cotton and cotton goods are holding off.

The grain markets have been relatively quiet, but in moments of activity the trend is upward, although the unexpected improvement in the corn crop acts as a repressive influence.

But general trade is not bad, and although car loadings and railroad earnings are still running below 1926, it is plain that inventories are small and must soon be replenished unless merchants are badly mistaken in their forecasts. Even steel is commencing to show some improvement and a note of confident hopefulness is to be heard in the talk of those who manufacture lumber, shoes, and many other essential staples of American life.

The news from abroad is neither more nor less significant than usual. Our foreign trade statement for October showed an increased balance of trade in favor of this country, and as the holiday season approaches a warrantable cheerfulness appears in the view of the future.

WHAT'S DOING IN INDUSTRY

SOME disappointment is expressed in certain industrial centers over the volume of machinery and machine tool business recorded during November. Conservative buying on the part of large users of machine shop equipment has resulted in a very spotty condition throughout the industry. Little improvement is looked for in December, which usually brings little else than clean-up business before books are closed.

CINCINNATI reports a slight increase in activity, with some lessening of sales resistance. Nothing has happened in Detroit to break the calm of a quiet season. Moderate activity in Chicago sustains a fair market. A decline in November sales volume is reported from Cleveland. Scattered replacement sales continue in Milwaukee.

BUFFALO notes a decided improvement in machine tool sales, with industrial conditions uniformly good. While sales are still spotty in New York, the general average is above October. Eastern New England reports a slightly better trend in both sales and inquiries. The Western section of New England is fairly busy, some demand for automatic screw machinery being noted. Optimism prevails in the Philadelphia district, where generally improved economic conditions forecast buying by industrial users of shop equipment.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

BUFFALO

The high point of the industrial equipment business in this district undoubtedly lies in machine tools at the present time, rather than in electrical or other equipment, as has been the case earlier in the year.

One machine tool dealer reported that his October business was much better than September, and that there is every indication that November business will be better than October. Some others were less enthusiastic but conditions nevertheless are uniformly good, perhaps the best of the year in this phase of the business. Inquiries are good and are on the increase.

In the electrical equipment field business is not generally as good as earlier in the year. The road and general contractors' equipment business seems to be at the low point of the season.

EASTERN NEW ENGLAND

The business outlook during the past week, taken as an average including both machine shop supplies and machine tools, in the Eastern New England section, shows a better inquiry and a slight improvement in volume. Heavier lines of machine tools give promise of better business to come, owing to keener competition in this field. Heavier equipment is in demand and a few sales have been consummated and business appears brisk. Transactions in machine shop supplies have increased, inquiries are better, and houses in this section feel that their stride has been regained.

WESTERN NEW ENGLAND

Machine tool builders in Western New England are booking a sizable amount of business with the automotive industry. There is a steady demand for automatic screw machines and presses, both new and rebuilt. The radio, electric and automobile small parts manufacturers take the bulk of these.

Business with the railroad industry is limited to single tools and straggling inquiries. One large builder expects little business from this source thru the balance of the year, and is not optimistic for 1928. Rigid economy, as practiced by that industry, and a perfection of central shop schedules, furnishes the explanation.

Recent orders for new machine tools include three automatic milling machines for an automobile manufacturer in the Central West, and a single automatic milling machine to a shock absorber manufacturer in New York. Tentative lists specify a New Britain chucking machine, a shaper and a vertical boring mill.

PHILADELPHIA

Inquiries among machinery and machine tool producers and dealers in the Philadelphia district this week revealed a note of optimism prevailing throughout the market. This was based, not upon actual business at hand, but rather upon the assumption that the underlying economic conditions have improved. There has been an improvement in the steel industry which has had a favorable reaction.

Firms dealing in machinery used by the railroads found some small business from Eastern carriers during the last two weeks, but no large purchases were made. Some inquiries having a hopeful tone were received. Producers of gears reported a dull outlook. There has been little buying from general machinery dealers. One of the shipbuilding plants along the Delaware river has received orders for some tankers and barges and its working force has increased from a normal of 800 to approximately 3,000 men.

NEW YORK

With but a few more days left in November, dealers and manufacturers' agents in this territory have varied reports to offer as to the volume of current business. Some have received orders in satisfactory volume, while others report a disappointment. It is probably safe to assume that the average business is better than October, and on a par with the November volume of last year.

Inquiries are generally scarce, most of those received being for single machines. A fairly large list is reported issued by the Department of Commerce, acting for a large railroad repair shop in India. About thirty tools are asked for, but the specifications do not offer much encouragement to American manufacturers.

Radial drills, lathes of various capacities, brakes, surface grinders, vertical shapers, centering machines, a profiler and three rotary surface grinders were among the tools reported in sales last week.

CHICAGO

A better feeling prevails in the machine tool industry, due to moderately increased activity in sales and a greater number of inquiries that indicate the placing of orders in the near future. Dealers and local representatives of machine tool manufacturers express themselves as encouraged by the business outlook, which has assumed a brighter apect within the last ten days.

While it is not expected that demand will show any marked upward trend for the remainder of the year, there seems to be sufficient business in sight to justify the belief that before the year ends the average of sales will be raised to a fairly satisfactory level. Railroads continue to buy in small lots, chiefly for replacement purposes. Industrialists are sending in occasional orders, a few of which are for heavy duty equipment. Dealers in used machinery report an improved situation, and salesmen covering local and nearby territory are booking more orders than for the last several weeks.

MILWAUKEE

Sales of metal working equipment continue to be of a scattering nature, with few firms doing more than to fill the most urgent requirements, these being almost entirely of a replacement character. New industrial plant projects are small in number, and activity with respect to shop enlargement likewise is restricted by the ability of existing capacity to handle current orders.

There is a moderate degree of inquiry from the automobile trade, and it seems evident that most factories are looking after needs that would develop in case of an expected revival of passenger car demand.

Official employment figures of 47 reporting shops in this territory indicate that more men are at work than a year ago, although there has been a gradual decline in the last three to four months. The demand for skilled labor for metal working plants is less insistent than it was in the earlier months of the year, but there is no visible surplus of this type of worker.

CLEVELAND

Sales of machinery and machine tools showed a sharp decline during the first two weeks of November, compared with the last half of October. The reaction is causing a feeling of disappointment. The local trade was hopeful that the recent upward swing would last until the middle of December. Not much business is looked for until after the first of the new year. Orders coming into the local market were for single tools and replacements. Inquiries are also showing a decline.

Best business at the present time is in the automatic and punch and press lines. They report a slight increase in sales. The used tool market is showing some activity.

DETROIT

No particularly noteworthy orders have come to break the condition of quiet prevailing here. Many of the dealers in machinery and machine tools report fair business, but none of them are highly optimistic. At present there are a few automobile manufacturers buying equipment, but they are buying slowly and conservatively. One concern received a good sized order for milling machines and expects another similar order in the near future. A number of inquiries are being received and many of them seem to indicate a tendency to buy soon.

Employment figures have changed little since last week and the large employers of labor hold out no promises for this month or next.

CINCINNATI

Machine tool concerns in the Cincinnati district had a slightly increased volume of sales in the past week. According to manufacturers of all varieties of tools there is a very large amount of business pending, but the big problem is to find a way of breaking down the great amount of sales resistance which conservatism has brought about. Selling agents report that while the demand in the city did not show any material change in the past week, it showed an improvement in surrounding territory.

The great majority of the orders booked in the week were for single tools and replacements. These came principally from general machinists and miscellaneous users in all sections of the country. A few small export orders are reported, these being from Holland, France, Australia and South America. Purchases made by railroads and automobile manufacturers were small. Inquiries came in freely during the week, the major part of them being in regard to single tools for replacements.

Although the demand is not as great as it was expected to be at this time, the general feeling is optimistic and it is confidently expected that sales will reach a decidedly higher level before the close of the present year.

Personnel Conference in New York

That personnel problems are receiving more and more attention each year was indicated by the attendance at the annual autumn conference of the Personnel Research Federation at the Hotel Pennsylvania, New York, Nov. 17 and 18. Four topics were chosen for discussion, Research in Susceptibility to Accidents and Accident Reduction; Study and Measurement of Leadership; The Personal Interview, its Technique and Reliability in Fact-Finding and Discovery; and Measurement of Mechanical Abilities. There were also two dinner meetings.

Among the speakers were several well-known personnel managers from large industrial concerns, as well as those engaged in training employees, both apprentices and older operators. Methods of interviewing and of determining mechanical aptitude were discussed and examples given. The study and measurement of leadership brought out considerable discussion by Ordway Tead, T. M. Stakes and others, and emphasized the demand for leaders in all branches of industry.

As an indication of the growth of interest in personnel and kindred subjects, the leading colleges now have departments devoted to research of personnel problems and for the training of young men and women to carry on this work in industry. College instructors occupied a prominent place on the program.

Europe Built More Autos in 1926

European production of passenger cars, trucks, and buses totaled 560,213 units during 1926 as compared with 462,120 in 1925, an increase of 98,093 units or 21 per cent, according to the automotive division of the Department of Commerce.

The manufacturing countries of Europe exported during 1926 a total of 132,802 units as compared with 123,412 units in 1925, this being an increase of 7.6 per cent during this period. Italy accounted for a substantial part of this increase by augmented shipments of the small model Fiat.

France, with a reported 1926 production of 200,000 passenger cars, trucks, and buses as compared with 177,000 in the previous year, is technically the leader in production in Europe, although British makers press that figure very closely. Exports play a relatively large part in the French automobile industry.

British production in 1913 amounted to 44,000 units, double that of the previous year. In the year 1922 the annual production totalled 73,000 units, and this grew steadily until in 1925 it was 133,500 passenger cars and 43,300 trucks and buses. The British motor industry was severely handicapped by the industrial disturbance in 1926. However, production increased to 158,699 passenger cars and 40,000 trucks and buses in that year. Exports in 1926 totaled 33,137 compared with 29,050 in 1925.

During 1926 Italian factories produced 64,760 motor vehicles, which was nearly double the 1925 production figure of 39,473 units. The Fiat company accounts for about 85 per cent of all Italian production. Since 1924, when Italy exported 18,988 automobiles, the number of unit exports has jumped to 29,061 in 1925 and 34,194 in 1926.

German production was only 55,000 units in 1925 and 75,000 in 1926, according to best available reports. German exports of motor vehicles have become relatively insignificant since the World War period, totaling only 1,491 passenger cars and 296 trucks and buses in 1925, while the comparable totals in 1926 were 1,267 and 814 units respectively. These exports in 1926 represented only 3 per cent of German production.

Will Aid Educational Research Work

For the purpose of aiding universities, colleges and other agencies in the elimination of wasted effort and duplication in the study of educational problems, the Bureau of Education of the Interior Department has established a clearing house on current research work in education.

Recent investigations have resulted in the discovery that in many institutions of higher learning and research organizations original studies into educational questions have been started by members of their staff or by students, only to find that the same work was being prosecuted without their knowledge in other institutions or within the different departments of their own institution.

A comprehensive list has been made of all higher educational institutions and agencies engaged in original studies of educational questions or preparing works on such subjects. Requests are now being sent for copies of all completed and current educational researches being carried on by them.

Concern Over Source of Skilled Labor

Concern over the supply of skilled labor necessary to American industries is reflected in a bulletin issued recently by the Department of Manufacture of the Chamber of Commerce of the United States.

"At a recent dinner honoring industrial veterans," the Department says, "one concern marshalled more than 500 men who had been in its employ from 25 to 60 years. How are they, with their skill and experience, to be replaced?

"We can no longer depend upon trained immigrants or upon neighboring plants as sources of supply. Moreover, in securing volume production from expensive labor saving machinery commensurate with its cost it must be placed in trained and careful hands—again suggesting systematic training.

"Unfortunately there are still those who say that 'we can go out and hire what skill we need.' Perhaps some can do this in certain localities where others have been doing the training. But it is obvious that were this policy universally adopted there must soon come an end to this supply of skill, and if we face the facts many sections have already seen the handwriting on the wall."

"The most effective answer," the bulletin continues, "is a citation of facts. Young American boys are being inducted into trades and shops in certain localities where attractive training has been developed. Industrial success and prosperity are turning the eyes of the younger generation to industry's opportunities and away from the so-called white collar jobs."

Personals

L. R. POWELL, JR., has been elected president of the Seaboard Air Line Ry.

S. B. BUSH has resigned as president of the Buckeye Steel Castings Co., of Columbus, Ohio.

CHARLES G. SPICE has resigned from the Hyatt Roller Bearing Co. and has become associated with the Chrysler Corporation, at Detroit.

VICTOR ALLEN has been appointed vice-president in charge of sales for the Automotive Maintenance Machinery Co., of Chicago.

FRANKLIN A. MILLER has resigned as vice-president of the Gill Manufacturing Co., and has become vice-president and general manager of the Diamond Piston Ring Co., of Baltimore.

W. L. KENNEDY has been appointed sales manager of the pump and tank division of the Wayne Co., of Fort Wayne, Ind. Mr. Kennedy succeeds A. D. Carriger, who has been elected vice-president and director of sales.

D. F. GEISSINGER has opened an office at 602 Oliver Bldg., in Pittsburgh, as representative for the Sundstrand Machine Tool Co., and the Barnes Drill Co. He was formerly on the sales force of the Somers, Fitler & Todd Co., in Pittsburgh.

DR. ROBERT J. ANDERSON has become associated with the Fairmont Manufacturing Co., of Fairmont, W. Va. Dr. Anderson is an expert on the metallurgy of aluminum and will be in charge of the company's aluminum rolling mills at Fairmont.

DR. W. D. COOLIDGE, assistant director of the research laboratory of the General Electric Co., has been awarded the Hughes medal by the Royal Society for distinguished work on X-rays and the development of highly efficient apparatus.

R. W. BLANCHARD has been elected president of the Hart & Cooley Manufacturing Co., of New Britain, Conn. Mr. Blanchard was manager of the company's Chicago office for many years. J. H. Robinson, former president, has become chairman of the board.

ARTHUR H. ADAMS, assistant superintendent of manufacturing development at the Hawthorne Works of the Western Electric Co., Inc., assumes on Dec. 1 the position of technical adviser to the president of the Manhattan Electrical Supply Co., with headquarters at 11 Park Place, New York City.

CHARLES E. F. CLARKE, who has been vice-president of the Baltimore Tube Co., and the Eastern Rolling Mills Co., of Baltimore, has been elected chairman of the board of both companies. He succeeds John M. Jones, who died recently. The directors have elected A. J. Hazlett, formerly sales manager for the Eastern Rolling Mill Co., president of that company. C. S. Inglis has been elected president of the Baltimore Tube Co.

Business Items

The Wesson Sales Co., of Detroit, has moved into larger quarters in its present location at 7338 Woodward Ave.

The Hyro Manufacturing Co. has moved into new quarters at 200 Varick St., New York.

The Chandler & Farquhar Co., of Boston, has been appointed agent in that territory for the New Britain Machine Co., of New Britain, Conn.

The Southern Railway System has awarded contracts for the construction at Wilmington, N. C., of a new roundhouse and machine shop building, according to a recent announcement.

The Reliable Tool Co., Laredo, Tex., is a new firm organized and incorporated as distributor in the Texas and the Southwestern territory of machinery and machine tools. Incorporators include John S. Morris, A. C. Savay and D. Trevino.

The Utility Equipment Co., 1035 East 76th St., Chicago, has been incorporated. The company will manufacture and deal in railway appliances, signal equipment, machinery and tools.

The Nolen Machinery Co., Inc., has been organized to engage in the machinery business as dealer at Shreveport, La. Incorporators include M. P. Nolen, of Shreveport, identified with the business in the Southeast for some time.

The plant, real estate and equipment of the Crawford & McCrimmon Co., sawmill machinery manufacturer at Brazil, Ind., has been ordered sold to the highest bidder. The circuit court has issued the order to D. W. Wood, receiver for the machine shops and foundry.

The Wallace Barnes Co., of Bristol, Conn., spring manufacturer, has moved its screw machine department into the old plant of the Garrigus Machine Co. on Riverside St. This department is on a day and night schedule.

Incorporation has been granted in Canada to a company to be known as the Heat Exchange Apparatus, Ltd., which proposes to manufacture steam, water, air and electrical heating machinery and appliances. The company will be capitalized at $300,000 and headquarters will be in Montreal.

The Peerless Unit Ventilation Co., Long Island City, N. Y., has acquired a plant at 718-34 Crescent Ave., Bridgeport, Conn., and is installing machinery for the immediate production of unit heaters. A sales office has been opened at 369 Lexington Ave. in New York City.

The Pierce Arrow Motor Car Co. of Buffalo, N. Y., announces the election of two new members of the board of directors: Col. John R. Simpson of New York, and Rudolph B. Fiershem of Buffalo. A convention of distributors and dealers was recently held in Buffalo.

The Hughes Tool Co., Houston, Tex., manufacturer of tools and machinery used in oil well drilling, has awarded contracts for construction of a one-story, 140 x 300-ft. addition to the company's machine shop unit to cost about $75,000, not including equipment. H. R. Hughes, of Houston, is president of the company.

Sterling Electric Motors, Inc., has been organized in Los Angeles, Calif., to manufacture a line of electric motors and motor specialties. Carl E. Johnson, formerly vice-president of the U. S. Electrical Manufacturing Co., is president of the new concern. Associated with Mr. Johnson are: J. M. Sharp, Earl Mendenhall, Allen A. Adams and Horace S. Walling.

The W. A. Griswold Co., recently incorporated at Nashville, Tenn., is reported in the market for machinery and other equipment used in the manufacture of stoves and ranges for a new plant the company plans to establish at Nashville. A building for the plant has been leased and it will be remodeled for the company's use.

Gibson & Halpern, machinery sales agents in New York, have moved into new offices at 63 Wall St. This firm was recently organized and in addition to domestic trade, the company will make a specialty of export business. D. J. Gibson was for many years associated with the export department of the Worthington Pump and Machinery Corporation. B. M. Halpern was also associated with this company, but more recently has been engaged in engineering work in South America.

Obituaries

A. G. HENRICKS, vice-president and general manager of the Harnischfeger Corporation, of Milwaukee, died on Nov. 9.

H. G. STEINBRENNER, vice-president of the Brown Industrial Hoist Corporation, of Cleveland, Ohio, died suddenly in Chicago on Nov. 15.

JOHN F. WADE, formerly works manager of the rolling mill of the Bristol Brass Corporation, Bristol, Conn., and recently Mayor of that city, died suddenly on Nov. 7.

DAVID NASH ARMSTRONG, president and general manager of the Armstrong Manufacturing Co., Bridgeport, Conn., manufacturer of pipe cutting and fitting tools, died recently at his home in Huntington. Mr. Armstrong was 51 years old and a native of Bridgeport, Conn.

EDWARD HUBBARD WELLS, chairman of the board of Babcock & Wilcox, water tubular boiler manufacturers, of New York, died on Nov. 17 at his home in Montclair, N. J., after an illness of four months. He started with the Babcock & Wilcox firm in 1892 as engineer in charge of sales. In 1898 he became president of the company, holding that position until eight years ago, when he became chairman.

CHARLES S. MELLEN, once known as "Czar of New England railroads," died Nov. 17 at the home which he had maintained near Concord, N. H., since his retirement in 1913. When he was thirty-two years old Mr. Mellen was general superintendent of the Boston & Lowell R.R. Four years later he went with the Union Pacific as purchasing agent for a year, returning to Boston in 1892 to become general manager of the New York & New England Railroad, and shortly thereafter president of the New York, New Haven & Hartford.

FREDERICK F. FITZPATRICK, president of the American Locomotive Co., died on Nov. 16 at his home in Larchmont, N. Y. He had been ill for several months. He was an active figure in the steel industry. He was president of the Montreal Locomotive Works, Ltd.: the Canadian Steel Tire and Wheel Co.: the American Locomotive Sales Corporation, and the Richmond Locomotive Works, and vice-president of the Railway Business Association. He held directorships in the American Brake Shoe and Foundry Co., American Car and Foundry Co., American Car and Foundry Securities Co., Canadian Steel Tire and Wheel Co., the Montreal Locomotive Works, the Railway Steel Spring Co., the Safety Car Heating and Lighting Co., and the Super-Heater Co.

Used Car Exposition

The second annual French used-car fair, held in permanent exposition buildings at the Porte de Versailles, Paris, during the annual automobile salon, last month, again demonstrated its practicability in helping to solve the used-car problem in France. Of the 1,397 vehicles shown during the 11 days, approximately 40 per cent were disposed of during the period of the fair. Most of these were small, low-priced passenger cars, trucks, and motorcycles, and in practically all cases they represented actual sales. It is planned to hold a third fair of this kind next fall on a larger scale than this year.

Calendar of Local Meetings

American Society of Mechanical Engineers

Buffalo. Dec. 13. Hotel Statler, evening. Subject: "The Present Standing of the Various Standards Now Being Developed for Valves and Fittings for High Pressure Steam Service," by F. H. Morhead, chief engineer, Walworth Company.

New Orleans. Nov. 28. Meeting of the executive committee for the purpose of giving instruction to the delegates to the annual meeting in New York.

Schenectady. Dec. 8. Old Chapel, Union College, evening. Subject: "Recent Developments in Phenol Products," by Dr. L. V. Redman.

St. Louis. Dec. 2. Hotel Roosevelt. Dinner for past chairmen of the St. Louis local section.

Tri-Cities. Dec. 8. Rock Island Arsenal Cafeteria, Rock Island, Ill. Subject: "Centerless Grinding," by J. E. Caster, Cincinnati Grinders Corporation.

National Association of Cost Accountants

Hawaii Chapter. Nov. 28. Subject: "Sugar Plantation Accounting—Practical Methods vs. Theory," by Arthur Grounds.

Kansas City Chapter. Nov. 28. Subject: "Various Phases in Factory Insurance."

Baltimore Chapter. Dec. 20. Subject: "The Thirteen Period Accounting Year."

Boston Chapter. Dec. 15. Subject: "The Superintendent Looks at Cost Accountants."

Buffalo Chapter. Dec. 15. Subject: "Mechanical Aids to Industrial Accounting," by Harry C. Spillman, Remington-Rand Inc., New York.

Chicago Chapter. Dec. 15. "The Relation of Distribution of Costs to Budgetary Procedure," by F. Hunter Corregan, General Electric Co., Schenectady, N. Y.

Cleveland Chapter. Dec. 21. Subject: "Problems of Stock Taking and Inventory Control."

Forthcoming Meetings

A conference on industrial electrical heat-treatment will be held at Yale University, New Haven, Conn., under the auspices of the electrical engineering department and in co-operation with the Manufacturers' Association of Connecticut, on Nov. 30. Tickets of admission must be obtained from either of the above bodies.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York City, Dec. 5 to 8. C. E. Davies, assistant secretary in charge of meetings, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Sixth annual event in the Grand Central Palace, New York, Dec. 5 to 10. Charles F. Roth, manager, Grand Central Palace, New York City.

Power Transmission Association. Annual meeting, Dec. 7, Hotel Commodore, New York City. W. S. Hays, secretary, Drexel Bldg., Philadelphia.

American Association for the Advancement of Science. Second Nashville meeting, Nashville, Tenn., Dec. 26-31, general headquarters Andrew Jackson Hotel. General chairman, W. S. Leathers, M.D., professor of preventative medicine and public health, Vanderbilt Medical School, Nashville, Tennessee.

The Weekly Price Guide

Rise and Fall of the Market

DECIDED improvement in the tone of the metals market is noted in this week's transactions. The pig-iron movement appears in larger volume, compared with recent weeks; steel prices, production and reserve stocks tend upward; non-ferrous metals are stronger. Prices range higher than on Nov. 11, in copper sheets and bars, also scrap brass, copper and lead. The steel sheet market shows signs of improvement; there is increasing demand for steel rails. Wiping cloths and linseed oil advanced during the last week. Downward tendencies developed in prices of steel scrap, strip steel, and wire products. Steel shapes, plates and bars are $1.75 per 100 lb., Pittsburgh, in large tonnages; $1.80 for car lots; and $1.90 per 100 lb. on less-than-carload quantities.

(All prices as of Nov. 18)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	17.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	4.75@5.25
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.15	3.50	3.25	3.89
No. 12	2.15@2.20	3.55	3.30	3.94
No. 14	2.20@2.25	3.60	3.35	3.99
No. 16	2.30@2.35	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.70@2.80	3.75	3.55	4.00
No. 22	2.85@2.95	3.90	3.70	4.15
No. 24	2.90@3.00	3.95	3.75	4.20
No. 26	3.00@3.10	4.05	3.85	4.30
No. 28	3.25@3.35	4.20	4.00	4.45
Galvanized				
No. 10	2.95@3.05	4.10	3.80	4.25
Nos. 12 to 14	3.05@3.15	4.20	3.90	4.35
No. 16	3.15@3.25	4.30	4.00	4.45
No. 18	3.30@3.40	4.45	4.15	4.60
No. 20	3.45@3.55	4.60	4.35	4.75
No. 22	3.50@3.60	4.65	4.40	4.80
No. 24	3.65@3.75	4.80	4.50	4.95
No. 26	3.90@4.00	5.05	4.75	5.20
No. 28	4.15@4.25	5.30	5.00	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	¾	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	5.70	6.10
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex.†	4.00	3.65	3.60
Cold drawn, flats and squares	4.50	4.15	4.10
Structural shapes	3.34	3.00	3.10
Soft steel bars	3.24	3.00	3.00
Soft steel bar shapes	3.24	3.00	3.00
Soft steel bands	3.99	3.65	3.65
Tank plates	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@⅛-in. thick. †Shafting and screw stock.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			14.87½
Tin, pigs, 5-ton lots, New York			58.87½
Lead, pigs, up to carlots, E. St. Louis	6.00	New York	6.87½
Zinc, slabs, up to carlots, E. St. Louis	5.70	New York	6.62½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	13.25	14.00	13.00
Copper sheets, base	22.25	22.00	22.00
Copper wire, base	18.75	18.75	15.25*
Copper bars, base	21.75	21.50	21.50
Copper tubing, base	24.00	24.00	24.00
Brass sheets, high, base	18.25	18.25	18.25
Brass tubing, high, base	23.12½	23.12½	23.12½
Brass rods, high, base	16.00	16.00	16.00
Brass wire, high, base	18.75	18.75	18.75

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	24.37½@25	26@27	26.02
Zinc sheets (casks)	11.00	11.55	10.11
Solder (½ and ½), (case lots)	35.75	37.00	34@38

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	75.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	12.50

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	37.00
Shot	36.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	11.62½@11.87½	10.75	10.00@10.50
Copper, heavy, and wire	11 12½@11.62½	10.75	9.75@10.25
Copper, light, and bottoms	10 00 @10.25	9.25	8.75@ 9.25
Heavy lead	5.00 @ 5.37½	5.25	4.50@ 5.00
Tea lead	4.00 @ 4.25	3.75	3.50@ 4.00
Brass, heavy, yellow	7.00 @ 7.50	7.00	6.75@ 7.25
Brass, heavy, red	9.00 @ 9.50	9.50	8.75@ 9.25
Brass, light	5.25 @ 5.75	5.50	5.75@ 6.25
No. 1 yellow rod turnings	7.25 @ 7.75	7.00	6.75@ 7.25
Zinc	3.50 @ 3.75	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@ 17
Wiping cloths, washed white, per lb	.15½@17½	36.00 per M	.15
Sal soda, per lb	.03½	.02	.02¾
Roll sulphur, per lb.	02⁷	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.79½	.94	83
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.27	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	35%	35%	35
Heavy grade	30%	30%	30
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft			
First grade	50%	50–10%	50%*
Second grade	50–10%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60-10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.16	.16	.1662½
Solder (½ and ½)	per lb.	.35¾	36.25	42¾
Cotton waste, white	per lb.	.10@13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.27	.27	.35
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.8[illegible]	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville, 2.75@3.00	
Coke, prompt foundry, per net ton		Connellsville, 3.75@4.50	
White lead, dry or in oil,	100 lb. kegs	New York, 13.75	
Red lead, dry,	100 lb. kegs	New York, 13.75	
Red lead, in oil,	100 lb. kegs	New York, 15.25	

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1¼ and 1½ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb.	$3.50*
Rivets, button and cone head:	
Small, including ⅛-in. dia.	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.

*$1.50 off list for broken keg lots. †$6.50 broken keg lots, net.

Machine Requirements and Industrial Construction

Equipment Wanted

Ga., Atlanta—Chevrolet Motor Co., General Motors Bldg., Detroit, Mich.—machinery and equipment for proposed 1 and 3 story, 483 x 762 and 65 x 240 ft. auto assembly plant on Sawtell Rd. here.

Mass., Arlington (Boston P. O.)—H. L. Frost Co., 20 Mill St.—miscellaneous tools and equipment for proposed 2 story, 60 x 70 ft. repair and service garage. Estimated cost $40,000.

Mass., West Roxbury (Boston P. O.)—L. W. Moody, 29 Gould St.—machinery and equipment for proposed 1 story, 50 x 70 ft. machine shop.

Mich., Detroit—Detroit Lubricator Co., 5842 Trumbull Ave.—machinery and equipment for the manufacture of carburetors, lubricating equipment, etc. for proposed 2 story, 65 x 110 ft. auto parts factory. Estimated cost $50,000.

Mich., Detroit—Gorham Tool Co., 2206 Twelfth St.—miscellaneous equipment for proposed 1 story, 60 x 135 ft. machine shop on Woodrow Wilson St. Estimated cost $50,000.

O., Barberton—Ohio Injector Co.—Toledo Press, No. 35 P.

O., Cleveland—Bd. of Education, F. G. Hogen, Dir.—lathe and forge for proposed 1 story foundry for Eagle Trade School on Eagle Ave. Estimated cost $40,000.

Okla., Oklahoma City—Sheffield Steel Co., Railway Exchange Bldg., St. Louis, Mo.—foundry and machine shop tools including riveting, boring and punching machines, welding equipment and cranes for proposed machine shop here. Estimated cost $100,000.

Pa., Pittsburgh—Dept. of Public Works, Bureau of Highways & Sewers—rip and cross cut saw with table, motor driven, Ordinance passed No. 669.

Opportunities for Future Business

Calif., Long Beach—General Motors Co., 4584 Maybury St., Detroit, Mich., plans the construction of a factory here. Estimated cost $150,000.

Calif., Los Angeles—Brunswick-Balke-Collendar Co., 84 South Los Angeles St., manufacturers of billiard tables, etc., is having preliminary plans prepared for the construction of a 1 story, 177 x 400 factory at Union Pacific Industrial Tract. Estimated cost $300,000. The Morgan Co., 740 South Broadway, Archt.

Calif., Los Angeles—C. F. Plummer, 1108 Story Bldg., Archt., will soon receive bids for the construction of first unit of factory, 100 x 100 ft. at Union Pacific Industrial Tract for Sterling Electric Motors Inc., 124 West 4th St.

Calif., Oakland—Boorman Lumber Co., 10035 East 14th St., Los Angeles, plans the construction of a planing mill at 102nd Ave. and East 14th St. here. Estimated cost $10,000.

Calif., San Francisco—Pacific Gear & Tool Works, 1035 Folsom St., plans the construction of a shop at First and Natoma Sts. Estimated cost $10,000.

Calif., San Francisco—Western Alloy & Tool Steel Co., 562 Bryant St., awarded contract for the construction of a 1 story shop at 6th and Brannan Sts. Estimated cost $15,000.

Conn., Norwalk—Vaast Bros., 17 Chestnut St., had plans prepared for a 1 story, 105 x 80 ft. garage and repair shop at Connecticut and Glenwood Aves. Estimated cost $75,000. Private plans.

Ill., Chicago — F. Voras, 4101 North Western Ave., awarded contract for a 1 story, 40 x 135 ft. addition to machine shop at 4541 West Lake St. Noted Nov. 3.

Ill., St. Charles—E. J. Baker awarded contract for a 1 story garage. Estimated cost $50,000.

Ind., Cambridge City—Western Oil & Refining Co., 310 North Meridian St., Indianapolis, is receiving bids for a machine shop, etc. here. Estimated cost $40,000. Bishop, Knowlton & Corson, 312 North Meridian St., Indianapolis, Archts.

Ind., Muncie—Warner Gear Co. awarded contract for the construction of a machine shop.

La., Shreveport—Southwestern Cast Iron Pipe Co., c/o L. L. Featherstone, 516 Daizell St., plans the construction of a plant including foundry and machine shop, etc.

Mass., Boston—Meisel Press Mfg. Co., plans a 1 and 2 story, 100 x 225 ft. factory. Estimated cost $40,000. H. S. Cleverdon, 46 Cornhill, Boston, Archt.

Mass., Boston—U. S. Government, Post Office Dept., Washington, D. C., will receive bids until Nov. 30 for a 3 story, 115 x 300 ft. garage at 176-194 Ipswich St. here. Private plans.

Mass., Everett (Boston P. O.)—Melanson Bros Inc., 67 Chelsea St., awarded contract for a 1 story, 75 x 115 ft. shop on Chelsea St. Estimated cost $40,000. Noted Nov. 10.

Mass., Hyannis—J. H. Connelly, Depot Sq., awarded contract for a 1 story repair and service garage on Centre St. Estimated cost $40,000. Noted July 14.

Mass., Roxbury (Boston P. O.)—Chickering & Sons, 791 Tremont St., Boston, manufacturers of pianos, is receiving bids for the construction of a 1 story factory at 18 Station St. here. Estimated cost $40,000. Monks & Johnson, 99 Chauncey St., Boston, Archts.

Mass., Somerville (Boston P. O.)—Birch Bros., 32 Kent St., manufacturers of textile machinery, awarded contract for a 2 story factory.

Mass., Wareham—E. C. St. Jaques, High St., Cranberry Corners, plans the construction of a 1 and 2 story factory and garage, etc. on Main St. Estimated cost $40,000. Architect not selected.

Mass., Worcester — Nash Automobile Agency, 747 Main St., is having plans prepared for the construction of a repair and service garage on Park Ave. Estimated cost $75,000. Frost Chamberlain & Edwards, 390 Main St., Archts.

Mass., Webster—H. Cohen, 63 Main St., plans the construction of a repair and service garage at 57 Main St. Estimated cost $50,000. Architect not selected.

Mich., Detroit — Chrysler Corp., 341 Massachusetts Ave., is having plans prepared for a 1 and 2 story, 60 x 400 ft. enameling plant for automobile factory on East Jefferson Ave. Smith, Hinchman & Grylls, 800 Marquette Bldg., Archts.

Mo., St. Louis—G. F. Carraher, 7467 Herman St., University City, manufacturers of sheet metal products, plans the construction of a shop at 4237 Olive St., here. Architect not selected.

N. J., Getterboro—Gates Day Aircraft Corp., c/o M. J. Finkelstein, 17 Academy St., Newark, plans the construction of a 2 story aircraft factory. Estimated cost $100,000. Private plans.

N. J., Hackensack—Hugh V. Keenan & Co., 20 State St., is having plans prepared for a 3 story garage at 309-313 Main St. J. L. Theo, Tillack-McFadden Bldg., Archt.

N. J., Hoboken—Ferguson Bros. Mfg. Co., 832 Monroe St., awarded contract for the construction of a 2 story factory for the manufacture of furniture at 704-720 Monroe St. Estimated cost $200,000. Noted Oct. 27.

N. J., Newark—Essex Foundry Co., Murray St., awarded contract for the construction of a 1 story storage building and mill room at Murray St. and Ave. D. Estimated cost $50,000.

N. J., Kearny—Western Electric Co. Inc., Lincoln Highway, will build a 1 story, 100 x 350 ft. telephone cable plant. Estimated cost $200,000. Private plans. Noted Sept. 29.

O., Dayton—Gem Metal Shield Co. Inc., Bacon and Bainbridge Sts., plans the construction of a 1 story, 100 x 200 ft. factory on Orchard St. Estimated cost $60,000. Architect not selected.

O., Youngstown — Smith Bros., c/o P. Boucherle & W. J. Canfield, Terminal Bldg., Archts., will soon receive bids for a 2 story garage on Wick Ave. Estimated cost $50,000.

Ore., Portland—Webster Chair Co., F. E. Thomas, Mgr., 15th and Thurman Sts., plans the construction of a factory at 27th and Nicoli Sts. Estimated cost $50,000. Architect and engineer not selected.

Pa., Chester — Ballinger, Co., 12th and Chestnut Sts., Philadelphia, Archt., is receiving bids on revised plans for a 3 story, 59 x 140 ft. factory for the manufacture of sheet material at 4th and Eagle Sts. for H. H. Ward. Noted Nov. 3.

Pa., Etna (mill Pittsburgh)—Etna Forge & Bolt Co., Commonwealth Bldg., Pittsburgh, plans a 1 story, 50 x 200 ft. addition to factory, here. Estimated cost $40,000. Private plans.

Pa., Houston — Pittsburgh Coal Co., Oliver Bldg., Pittsburgh, awarded contract for three shop buildings, 40 x 60 ft., 40 x 80 ft., and 40 x 60 ft., all 1 story, here. Estimated cost $40,000.

Pa., McKeesport — Columbia Radiator Co. awarded contract for a 1 story, 70 x 212 ft. addition to factory. Estimated cost $40,000. Noted Nov. 17.

Pa., Philadelphia — J. Warren Watson Co., 24th and Locust Sts., manufacturers of stabilators, has work under way on the construction of a 120 x 950 ft. extension to plant including office. Noted Oct. 27.

Pa., Washington—I. Richland & Co., H. Richland, Mgr., 27 Chartiers Ave., will soon receive bids for a 1 story garage on North Maiden St. W. H. Young, c/o Dunbar & Wallace Lumber Co., 829 Jefferson St., Archt.

Tenn., Memphis—Shelby Machine Co., 392 South Main St., had plans prepared for the construction of a 1 story factory and warehouse at Iowa and Michigan Sts. Estimated cost $40,000. E. L. Harrison, Fidelity Bank Bldg., Archt.

Tex., McAllen—Corporation being formed, c/o W. R. McGarity, Secy., Chamber of Commerce, has acquired a site and plans the construction of an airport including mechanical shop, etc. at International Highway. Estimated cost $60,000.

Vt., Rutland—F. R. Patch Mfg. Co., awarded contract for the construction of a 2 story, 80 x 145 ft. machine shop and garage.

Vt., West Rutland — Green Mountain Marble Corp., P. F. McCormack, Pres., awarded contract for the construction of a 1 story, 70 x 160 ft. saw mill and 1 story, 120 x 167 ft. finishing mill.

Wis., Milwaukee—Waltham Piano Mfg. Co., 1623 Island Ave., plans the construction of a 4 story, 80 x 250 ft. factory for the manufacture of pianos and radios at Island and First Aves. Estimated cost $100,000. Architect not selected.

Wis., Milwaukee — G. E. Zimmerman, 3402 Wisconsin Ave., awarded contract for a 1 story garage at 3200 Wisconsin Ave. Estimated cost $28,000.

Wis., Wausau—Marthon Investment Co., c/o W. Thom, awarded contract for the construction of a 1 story garage at 3rd and Grant Sts. Estimated cost $25,000.

Japan, Yokohama—Ford Motor Co., Highland Park, Mich., awarded contract for a 1 story, 300 x 480 ft. factory here. Estimated cost $1,000,000.